

Optimizing Document Retrieval in Local Government Digital Archives: A Sequential Search-Based Web Information System

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ABSTRACT

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Manual document archiving remains a common operational problem in local government administration, especially when official records are stored in physical folders, fragmented spreadsheets, or poorly indexed digital repositories. This study aims to develop and evaluate a web-based digital archiving system that applies the Sequential Search algorithm for document retrieval in local government administration. The study was conducted at the Department of Economic Administration and Natural Resources within the Regional Secretariat of Ponorogo Regency. The system was developed using the Waterfall model, consisting of requirement analysis, system design, implementation, and testing. The application was built using PHP and MySQL, with structured metadata stored in the database and PDF documents stored in the server directory. System validation was conducted through black-box testing, User Acceptance Testing involving ten administrative staff members, and retrieval performance testing across three record positions: beginning, middle, and end of the dataset. The results show that all core system functions operated successfully, the usability score reached 90.51%, and the retrieval time remained below 0.01 seconds under the tested conditions. These findings indicate that Sequential Search can serve as a practical retrieval mechanism for small-to-medium digital archive repositories where data volume is still manageable, implementation simplicity is required, and system maintenance capacity is limited. However, the linear complexity of Sequential Search suggests that future development should integrate indexing, full-text search, and OCR-based metadata extraction as archive volume increases.

1. Introduction

Digital transformation in public administration is no longer limited to online public services. It increasingly involves the redesign of internal administrative processes that determine how government institutions store, retrieve, and use information for daily decision-making. In local government offices, archived documents are not merely supporting files. They function as institutional memory, legal evidence, administrative proof, and operational input for reporting and policy coordination. Saldanha et al. emphasized that transparency and accountability in digital public services depend on reliable information practices and system-level validation [1]. In a similar direction, Yang et al. found that digital transformation can improve governmental

efficiency when digital initiatives are coordinated across departments rather than implemented as isolated technical projects c.[2].

Despite the growing emphasis on digital government, many local administrative units still rely on manual or semi-digital archiving practices. Documents may exist, yet they are difficult to locate when needed for verification, reporting, correspondence tracking, or service follow-up. This condition creates what may be called a practical retrieval gap: the archive is available, but its administrative value is weakened because access is slow and inconsistent. The issue is not glamorous, but it is painfully real. A document that takes ten minutes to find can quietly delay decisions, reports, and public service responses. Popa et al. showed that digitalization strengthens public organizational

management by improving planning, coordination, control, and operational efficiency [3]. Therefore, archival digitalization should be viewed not as a cosmetic modernization effort, but as part of the basic infrastructure of public-sector performance.

The Department of Economic Administration and Natural Resources within the Regional Secretariat of Ponorogo Regency faces a similar problem. Before the system was developed, document retrieval was conducted manually by checking physical records or semi-digital files. Preliminary observation indicated that finding a specific document could take approximately ten minutes. This delay becomes more significant when staff must handle repeated searches across different document categories, including correspondence, regional enterprise records, economic coordination files, and natural resource administration documents. Febiri et al. argued that public digitalization improves administrative performance when it is supported by human factors and institutional readiness [4]. In this context, a digital archive system must not only be technically functional, but also understandable, usable, and aligned with the work habits of administrative staff.

From an information system perspective, document retrieval in small-to-medium administrative repositories does not always require complex search infrastructure. Advanced methods such as indexed search, hashing, binary search, or full-text retrieval may offer better scalability, but they also require stronger data preparation, consistent metadata standards, and higher maintenance capacity. Sternad Zabukovšek et al. noted that the sustainability of document management systems is strongly related to organizational maturity for digital transformation [5]. This point is important for local government offices where information system maintenance is often constrained by limited technical staff, modest infrastructure, and formal bureaucratic procedures. In such environments, a simple retrieval mechanism may be more realistic than a sophisticated architecture that cannot be maintained properly.

Sequential Search offers a practical baseline for this type of repository. The algorithm checks records one by one until the target data are found or until all records have been examined. It does not require sorted data and is relatively easy to implement in a web-based information system. Previous studies on archive applications have

shown that Sequential Search can support document retrieval in web-based archival systems, particularly when the dataset is not yet large and the main objective is to improve access speed compared with manual search [13], [14], [15]. However, the algorithm is rarely discussed within the specific context of local government administrative workflows, where usability, staff acceptance, and practical retrieval improvement are just as important as algorithmic performance.

Based on this background, this study develops and evaluates a web-based digital archiving system using the Sequential Search algorithm for document retrieval in local government administration. The contribution of this study is threefold. First, it presents a lightweight archive management system that integrates structured metadata and PDF-based document storage. Second, it evaluates the system using functional testing, User Acceptance Testing, and retrieval latency measurement. Third, it discusses the practical boundary of Sequential Search as a maintainable retrieval mechanism for small-to-medium public-sector repositories. This study does not claim that Sequential Search is algorithmically novel. The novelty lies in its contextual implementation and empirical validation within a local government archive workflow.

2. Method

2.1 Research Site and System Context

This study was conducted at the Department of Economic Administration and Natural Resources within the Regional Secretariat of Ponorogo Regency, Indonesia. The unit manages administrative documents related to regional enterprises, economic coordination, natural resource affairs, and institutional reporting. These documents require systematic storage because they are frequently used for verification, monitoring, internal reporting, and administrative decision support.

Before the system was developed, document management was still dominated by manual and semi-digital practices. Staff had to check physical folders or scattered digital files to locate specific records. This process resulted in an average retrieval time of approximately ten minutes per document. Although ten minutes may look minor for a single search, the cumulative effect becomes substantial when staff must retrieve documents repeatedly in daily work. The system was therefore designed to reduce search latency, improve

metadata organization, and provide easier access to PDF-based archive files.

2.2 System Development Method

The system was developed using the Waterfall model. This model was selected because the institutional requirements were relatively stable and needed formal validation before implementation. In public-sector environments, development stages are often expected to be clearly documented, reviewed, and approved before moving to the next phase. Carter et al. argued that public-sector digital transformation requires strategic information systems that are designed, evaluated, and implemented with attention to public value [6]. The Waterfall model fits this context because it provides a structured development process that can be followed by both technical developers and administrative stakeholders.

The development process consisted of four stages: requirement analysis, system design, implementation, and testing. During requirement analysis, data were collected through observation and structured interviews with administrative staff. This stage identified document types, metadata fields, user roles, retrieval problems, and reporting needs. The design stage translated these requirements into system models, including use case diagrams, activity diagrams, database design, and interface structure. The implementation stage used PHP as the server-side programming language and MySQL as the relational database. The testing stage evaluated whether the system met functional, usability, and retrieval performance requirements.

2.3 System Design

The proposed system was designed as a web-based digital archiving platform. The system includes several main modules: user authentication, dashboard, document input, document management, document search, PDF upload, and report generation. The authentication module restricts access to authorized users. The dashboard provides a summary of archive records and supports monitoring of document availability. The document input module allows staff to enter metadata and upload PDF files. The search module enables users to retrieve documents based on keywords. The report module supports administrative reporting based on stored archive data.

The system separates document metadata from physical PDF files. Metadata such as document number, subject, document type, date, description, and file path are stored in the MySQL database. Meanwhile, the PDF files are stored in a server directory. This structure keeps the database lightweight while allowing users to access the original digital documents through the application interface. Damanik et al. reported that digital archive management research increasingly emphasizes records management, e-government, security, and interoperable digital archive systems [7]. Although the present system is modest in scope, its metadata-based architecture supports a basic but important movement toward more structured administrative records management.

2.4 Sequential Search Algorithm

The retrieval feature applies the Sequential Search algorithm. The algorithm receives a keyword from the user and compares it with the metadata stored in the database. The search process starts from the first record and continues linearly until a matching record is found or all records have been checked. If a match is found, the system displays the corresponding archive information and provides access to the related PDF file. If no match is found, the system returns a notification that the searched document is unavailable.

The general process of the Sequential Search algorithm used in this study is as follows:

1. User enters a search keyword.
2. The system reads archive records from the database.
3. The algorithm compares the keyword with relevant metadata fields.
4. If the keyword matches a record, the system stores the result for display.
5. If the keyword does not match, the algorithm continues to the next record.
6. The process stops after all records have been checked.
7. The system displays matching results or a "not found" message.

The algorithm has a time complexity of $O(n)$, where n represents the number of records. This means the search time may increase as the number of archive records grows. However, for the current archive scale, Sequential Search remains reasonable because it does not require sorted data, complex indexing, or additional preprocessing.

Melati et al. also applied Sequential Search for employee archive retrieval and reported that the method could support faster file search in a web-based archive management system [8]. Similar archive-related implementations have also used Sequential Search to improve document search accessibility in institutional contexts [9], [10], [11].

2.5 Testing Procedure

System testing was conducted using three evaluation layers: black-box testing, User Acceptance Testing, and retrieval performance testing. Black-box testing was used to verify whether the main system functions produced the expected output without examining the internal source code. The tested modules included login, document input, document update, document deletion, PDF upload, document search, and report generation.

User Acceptance Testing was conducted with ten administrative staff members who interacted directly with the system. The assessment focused on interface clarity, ease of navigation, feature suitability, retrieval usefulness, and overall user satisfaction. This testing was important because user acceptance strongly affects whether a system will actually be used after implementation. Chen and Aklilikou found that perceived usefulness and perceived ease of use influence e-government adoption [12]. Nguyen et al. also confirmed that perceived usefulness, perceived ease of use, trust, and engagement play important roles in e-government service adoption [13].

Retrieval performance testing measured execution time across three record positions: beginning, middle, and end of the dataset. This testing was conducted to observe whether record position affected search latency. Each test recorded the time required by the system to retrieve the target document. The results were then compared with the previous manual retrieval condition, which took approximately ten minutes per document.

3. Results and Discussion

3.1 Developed Digital Archive System

The result of this study is a web-based digital archive system that supports document input, metadata management, PDF storage, keyword-based retrieval, and report generation. The system was developed to help administrative staff manage archive records more efficiently and reduce dependency on physical document searching. The interface was designed with a simple layout so that

users could access major functions without complex navigation.

The dashboard provides a quick summary of archive data and gives users access to the main modules. Through the document input module, staff can enter metadata and upload the corresponding PDF file. The document management module allows users to edit, delete, and update archive records. The search module enables users to locate documents by entering keywords related to document number, subject, type, date, or description. This design follows the practical need of public-sector staff who require fast retrieval rather than complicated technical features.

The system architecture also supports basic records management discipline. By requiring metadata entry for every uploaded document, the system reduces the risk of unstructured digital storage. Without metadata, a digital archive can easily become a new version of manual clutter, only with more folders and better lighting. Sternad Zabukovšek et al. emphasized that document management systems must be managed across their life cycle to support sustainable digital transformation [5]. In the present system, structured metadata acts as the foundation for retrieval, reporting, and future scalability.

3.2 Functional Testing Results

Black-box testing was conducted to verify whether each module operated according to the expected requirements. The results show that all core functions worked successfully under standard operational conditions. The login module successfully restricted access to registered users. The document input module allowed users to enter metadata and upload PDF files. The document management module supported editing and deletion. The search module returned relevant records based on user keywords. The report module generated archive data according to selected criteria.

Table 1. Black-Box Testing Results

No.	Tested Module	Test Scenario	Expected Result	Result
1	Login	User enters valid username and password	User enters dashboard	Valid
2	Login	User enters invalid credentials	System rejects access	Valid

3	Document Input	User enters complete metadata and uploads PDF	Data saved successfully	Valid
4	Document Update	User edits existing archive data	Data updated successfully	Valid
5	Document Delete	User deletes selected archive data	Data deleted successfully	Valid
6	PDF Upload	User uploads PDF file	File stored and linked to metadata	Valid
7	Search	User enters relevant keyword	Matching document displayed	Valid
8	Search	User enters unavailable keyword	System displays not found message	Valid
9	Report	User generates archive report	Report displayed successfully	Valid

As seen on Table 1., the testing results indicate that the developed system met the functional requirements defined during the requirement analysis stage. This finding is important because public-sector information systems must first be reliable before they can be evaluated for broader impact. Saldanha et al. argued that validation, accuracy, and testing are part of accountability dimensions in digital public services [1]. In this study, black-box testing provides a basic assurance that the system operates consistently for its intended administrative functions.

3.3 User Acceptance Testing Results

User Acceptance Testing was conducted with ten administrative staff members. The assessment covered four main aspects: interface clarity, ease of navigation, feature suitability, and usefulness for archive retrieval. The overall UAT score reached 90.51%, which falls into the excellent category. This result indicates that users considered the system suitable for supporting daily archive management activities.

Table 2. User Acceptance Testing Results

No.	Assessment Aspect	Score Category
1	Interface clarity	Excellent
2	Ease of navigation	Excellent
3	Feature suitability	Excellent
4	Search usefulness	Excellent
5	Overall satisfaction	Excellent
Average UAT Score		90.51%

The high acceptance score suggests that the system was not only technically functional but also

aligned with the users' work routines. This point matters because public-sector technology adoption often fails not because the system cannot run, but because it does not fit the way staff actually work. Chen and Aklidikou showed that perceived usefulness and perceived ease of use influence behavioral intention to use e-government services [12]. Nguyen et al. further emphasized that ease of use and trust contribute to e-government adoption in emerging-country contexts [13]. In this study, the simple interface and familiar archive workflow likely contributed to the strong UAT result.

However, the interpretation of this score should remain cautious. The number of respondents was limited to ten staff members from one administrative unit. Therefore, the UAT result reflects acceptance within the studied institution rather than general acceptance across all local government offices. Weigl et al. warned that user-centric digital government can produce value conflicts when institutional assumptions do not fully represent diverse users [10]. For that reason, future testing should involve more participants, different administrative units, and longer usage periods.

3.4 Retrieval Performance Results

Retrieval performance testing was conducted by measuring search execution time across three record positions: beginning, middle, and end of the dataset. This testing was designed to observe how the Sequential Search algorithm performed under different search positions. The results are presented in Table 3.

Table 3. Retrieval Performance Testing Results

No.	Record Position	Average Retrieval Time
1	Beginning of dataset	0.00648 seconds
2	Middle of dataset	0.00772 seconds
3	End of dataset	0.00656 seconds

The results show that all retrieval times remained below 0.01 seconds under the tested conditions. Compared with the previous manual retrieval time of approximately ten minutes, the digital system provides a substantial operational improvement. The most important gain does not come from the complexity of the algorithm, but from the transformation of scattered archive records into searchable metadata. In other words, the system works well because the documents are finally organized in a form that the computer can search efficiently.

A small variation appeared in the retrieval time. The middle-position search produced a slightly higher time than the end-position search. Theoretically, Sequential Search may require more comparisons when the target record is located near the end of the dataset. However, in small datasets and web-based testing environments, minor variations may occur due to server caching, temporary system load, browser response, or database processing fluctuations. Since all recorded values were below 0.01 seconds, this variation had no practical impact on user experience.

These findings support the use of Sequential Search as a pragmatic retrieval method for small-to-medium administrative repositories. Melati et al. reported that Sequential Search can facilitate archive file searching in a web-based system [8]. Supiyanti et al. also applied Sequential Search in archive development and noted that it can support easier access to archive data [9]. Mugiarto et al. used Sequential Search in an incoming and outgoing mail archive system to help users find letter information more easily [10]. The present study extends these practical findings by applying the algorithm in a local government administrative unit and evaluating it using functional testing, user acceptance, and retrieval latency measurement.

3.5 Discussion

The results indicate that a simple search algorithm can generate meaningful administrative value when embedded in a structured digital workflow. This is the central point of the study. The improvement does not mean that Sequential Search is superior to more advanced retrieval methods. It means that, in the studied context, the combination of structured metadata, PDF storage, simple web access, and linear keyword search was sufficient to solve a real administrative bottleneck.

This finding is consistent with the broader literature on public-sector digital transformation. Carter et al. argued that public-sector information systems should be strategically deployed to create and sustain public value [6]. Jonathan et al. also noted that digital transformation can support public governance decentralization and organizational efficiency [14]. In the present case, public value is not produced through a large-scale smart government platform, but through a modest system that helps staff retrieve documents faster and more consistently. Sometimes the most useful

digital transformation is not the one with the flashiest dashboard, but the one that stops people from opening the same dusty cabinet five times a day.

The study also confirms the importance of user acceptance. A technically successful archive system will have limited impact if users perceive it as difficult, irrelevant, or disruptive. The UAT score of 90.51% suggests that the system matched user expectations and administrative routines. Febiri et al. emphasized that public digitalization is shaped not only by technology but also by human factors and institutional expectations [4]. This supports the argument that digital archive development should consider usability, work habits, and organizational readiness alongside technical design.

Nevertheless, the study has several limitations. First, the system was evaluated in one administrative unit, so the results cannot be generalized to all local government offices. Second, the number of UAT respondents was limited. Third, the retrieval performance test was conducted under the current archive scale, which may not represent future conditions when document volume increases significantly. Fourth, Sequential Search has $O(n)$ complexity, meaning that its performance may decline as the number of records grows. Hayati compared Sequential Search and Binary Search in a web-based e-archive search system and showed that algorithm selection becomes more important when retrieval efficiency is evaluated under different data conditions [15].

Future development should therefore integrate more scalable retrieval mechanisms. Index-based search can improve query speed for structured metadata. Full-text search can support more flexible retrieval across document content. OCR-based metadata extraction can reduce manual input and improve searchability for scanned documents. For documents related to natural resources and regional planning, future systems may also include geospatial tagging to classify archives by location. This direction would allow the system to evolve from basic digital archiving toward intelligent administrative decision support.

4. Conclusion

This study developed and evaluated a Sequential Search-based web information system for digital archiving in local government administration. The system was implemented at the Department of Economic Administration and Natural Resources

within the Regional Secretariat of Ponorogo Regency to address slow manual document retrieval. Before system implementation, locating a document could take approximately ten minutes. After implementation, retrieval testing showed that the system could retrieve documents in less than 0.01 seconds under the tested conditions.

The system also achieved successful results in black-box testing, indicating that the main modules operated according to functional requirements. User Acceptance Testing involving ten administrative staff members produced a score of 90.51%, suggesting that the system was accepted as useful and easy to operate. These findings show that a lightweight web-based archive system can improve document retrieval efficiency in small-to-medium local government repositories.

The main contribution of this study lies in demonstrating that Sequential Search can serve as a practical and maintainable retrieval baseline when archive volume is manageable and institutional maintenance capacity is limited. However, the algorithm should not be treated as a long-term solution for large-scale repositories. Future research should compare Sequential Search with indexed search, Binary Search, hashing, and full-text retrieval using larger datasets. Further development should also integrate OCR-based metadata extraction and document classification features to improve scalability, reduce manual input, and support more intelligent archive management.

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