

Semantic Object Model-Based Database Design for Archive Management: A Case Study at the South Sumatra Provincial Archives Service

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ABSTRACT

Purpose of the study: This research aims to design an integrated archive database system using the Semantic Object Model (SOM) approach to address the challenges of slow archive retrieval, high risk of loss, and non-compliance with Archive Retention Schedules at the South Sumatra Provincial Archives Service

Methodology: This qualitative research employed observation, interviews, and document analysis at the South Sumatra Provincial Archives Service. The database design followed three phases of SOM: conceptual (identifying semantic objects from archive forms and reports), logical (transforming objects into table relations), and physical (implementing in MySQL DBMS).

Main Findings: The research identified 19 semantic objects transformed into integrated database tables covering all archive types (active, inactive, vital, and static records). The design includes retention period attributes supporting Archive Retention Schedule compliance, with successful MySQL implementation.

Novelty/Originality of this study: This study introduces a comprehensive SOM-based archive database model integrating dynamic, vital, and static records with lending, media transfer, and retention control procedures in a unified design. Unlike previous semantic web applications focused on general data integration, this research addresses the specific regulatory requirements of government archive management based on actual user needs.

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1. INTRODUCTION

In the digital era, information technology plays an important role in improving organizational efficiency, including in government institutions. The Dinas Kearsipan Provinsi Sumatera Selatan still relies on a manual system for managing archives, which creates several challenges [1]. Recording archives in books leads to slow retrieval, frequent loss of documents, and improper follow-up that does not comply with the Archives Retention Schedule (JRA). These problems reduce the effectiveness of information services and administrative control. Therefore, the development of a structured archival information system has become an urgent necessity to ensure faster and more accurate information management.

The success of an information system largely depends on a well-designed database. A poorly structured database can make the system difficult to use, incomplete, and prone to data redundancy [2]. Therefore, choosing

an appropriate data model during the design phase is essential. Various studies indicate that the Semantic Object Model (SOM) approach is effective in aligning user understanding with the technical database structure. This model is based on real-world objects identified from commonly used forms and reports, making it more intuitive and user-oriented.

Although the Semantic Object Model (SOM) has been implemented in areas such as asset administration and education systems, its use in local government archives management especially within the Dinas Kearsipan Provinsi Sumatera Selatan remains limited [3]. Archives management involves complex processes, including handling dynamic, vital, and static records, as well as lending and media transfer procedures. These complexities require a comprehensive and integrated database design. Therefore, this study seeks to fill this gap by proposing a new approach to archival database modeling that is more structured and aligned with institutional needs [4].

Based on the results of the review of relevant articles, previous research shows that the Semantic Object Model (SOM) approach is widely used in database design in the fields of administration, academic systems, and asset management because it is able to identify real objects from forms and operational reports and translate them into a systematic database structure [5]. However, these studies still focus on the general organizational context and have not accommodated the specific characteristics of government archive management which has a complex life cycle ranging from dynamic, vital, to static archives and their relationship to the Archive Retention Schedule (ARS). On the other hand, research on archival information systems emphasizes more on the implementation of applications or the digitization of archives, without in-depth study of integrated semantic-based database modeling oriented to user needs [6]. To date, there has been no research that comprehensively applies SOM to model the entire archive life cycle in regional archival institutions, including loan procedures, media transfer, and integrated retention control. Therefore, there is a significant research gap in SOM-based archival database modeling in the context of local government, especially in the South Sumatra Provincial Archives Service, so this research is important to produce a model that is more contextual and appropriate to the real needs of the agency.

The novelty of this research lies in the application of the Semantic Object Model (SOM) to comprehensively model the archives life cycle in a local government archival institution [7]. This research integrates dynamic, vital, and static archives along with loan procedures, media transfer, and retention control according to the Archives Retention Schedule (JRA) in a single integrated database design. The developed model is designed based on the real needs of users at the South Sumatra Provincial Archives Office, making it more contextual and applicable [8]. This approach results in a structured database design oriented to the institution's operational needs. Thus, this research presents an innovation in SOM-based regional archival database modeling that has not previously been studied comprehensively.

Given these various problems and the existing research gaps, the need to design a structured, integrated, and regulatory-compliant archival database model is becoming increasingly urgent. Without an appropriate model, the archival information system risks being unable to address the slow retrieval of archives, the high risk of loss, and the inconsistency of management with the Archives Retention Schedule (JRA). Therefore, this research is important to provide a conceptual and technical foundation for developing a more effective and accountable system at the South Sumatra Provincial Archives Office [9]. This research aims to produce an archival database model based on the Semantic Object Model (SOM) that meets user needs. This design is expected to be the foundation for building an archival information system capable of addressing the problems of delayed archive retrieval, the risk of loss, and inconsistent archive follow-up.

2. RESEARCH METHOD

2.1. Types of research

This research uses a qualitative approach because it aims to understand and model database needs based on real-world conditions. Qualitative research methods are based on post-positivism philosophy and are used to examine objects in their natural state [10]. This approach was chosen because the research does not focus on testing hypotheses through experiments, but rather on deepening the meaning and processes that occur in archives management. The research results emphasize understanding the archival business process, which is then translated into database model design. Therefore, a qualitative approach is considered most appropriate for producing a model that suits the needs and real-world conditions of the organization.

2.2. Research Subjects and Objects

The object of this research is the South Sumatra Provincial Archives Service located at Jl. Demang Lebar Daun No. 4863, Palembang. The research subjects or informants are the agency's employees, particularly those directly involved in the archives management process [11]. The determination of informants was carried out purposively, that is, they were selected based on certain considerations because they were considered to have the best understanding of the problem being studied. The selected informants included archivists and service managers involved in recording, storing, borrowing, and controlling archives. Thus, the data obtained is expected to be relevant and in-depth in accordance with the focus of the research.

2.3. Data Sources and Data Collection Techniques

The data sources in this study consist of primary data obtained directly from the research location and secondary data derived from literature studies [12]. Data collection was conducted through triangulation to obtain complete and in-depth information. Observations were made by directly observing the ongoing archives management process at the South Sumatra Provincial Archives Service. Interviews were conducted with archives service employees to explore problems and identify user needs and documents used in archival activities. In addition, a literature study was conducted by reviewing literature, books, and scientific references related to databases, the Semantic Object Model (SOM), and archives management as a theoretical basis for the research.

2.4. Research Instruments

In qualitative research, the primary instrument is the researcher themselves (human instrument), who play an active role in planning the research, going into the field, collecting data, analyzing it, and drawing conclusions [13]. The researcher serves as the primary instrument because the process of data collection and interpretation relies heavily on their sensitivity and understanding of the context under study. Furthermore, this study utilized supporting instruments to support the data collection process. These instruments include interview guidelines, recording devices, and archival form documents obtained from the South Sumatra Provincial Archives Office. The use of these supporting instruments aims to ensure that the data obtained is more accurate and well-documented.

2.5. Data Analysis

The data analysis technique in this study was conducted inductively and qualitatively by following the database design phases using the Semantic Object Model (SOM) approach. In the conceptual phase, the researcher identified semantic objects based on archival forms and reports obtained from observations and interviews, then defined them into semantic object views along with their attributes, identifiers, and domains [14]. Next, in the logical phase, the results of the conceptual modeling were transformed into a logical data model in the form of table relations but were still independent of a particular DBMS. In the physical phase, the logical model was implemented into a physical database structure using the MySQL DBMS to produce a collection of archival database tables that were ready for use. These three analysis phases were carried out sequentially to ensure that the resulting database design truly met the needs of users at the South Sumatra Provincial Archives Service.

3. RESULTS AND DISCUSSION

This research resulted in the design of a database system for archive management at the South Sumatra Provincial Archives Service using the Semantic Object Model (SOM) approach [15]. The design was carried out through three phases, namely conceptual, logical, and physical. In the conceptual phase, the researcher identified 19 semantic objects from various archival forms and reports, such as PEGAWAI, SURAT_MASUK, DISPOSISI, ARSIP_AKTIF, and ARSIP_STATIS. Most of the objects are classified as compound, because they have attributes that refer to other objects, while some objects such as ARSIP_USUL_MUSNAH are classified as simple. The SOM modeling for the PEGAWAI object can be seen in the figure:

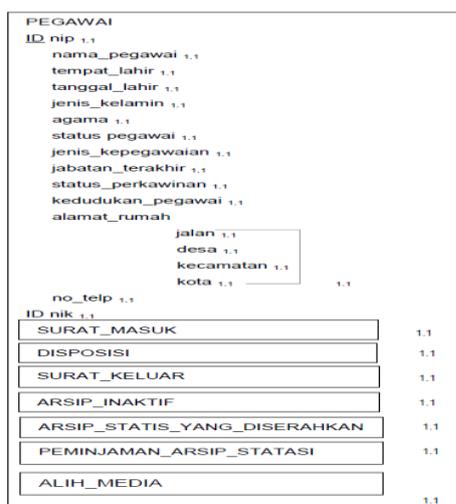


Figure 1. Shows attributes and their relationships with other objects.

In the logic phase, all semantic objects are transformed into interconnected table relationships in the database. The employee table has 17 fields with the NIP as the primary key, while the disposition table uses no_agenda as the primary key and is equipped with foreign keys to the incoming_letter, employee, disposition_content, and disposition_nature tables. The inactive_archive and vital_archive tables are equipped

with the `storage_term` attribute to support retention management according to archival needs. This transformation aims to maintain data integrity and consistency between tables to align with the archive management business process. Thus, the logic model is able to represent complex relationships between semantic objects in a systematic and structured manner [16].

In the physical phase, the logical model was implemented using MySQL DBMS by building a database named "kearsipan" consisting of 19 tables based on the modeling results. The implementation process and the successful creation of all tables were displayed through the phpMyAdmin interface [17]. These results demonstrate that the Semantic Object Model (SOM) approach is effective in producing an organized and systematic database structure. Because the modeling begins with an analysis of the interface and user needs, the resulting database structure becomes more relevant to the archives management process. Thus, the SOM-based design is proven to be able to support the archives business process in a more structured, consistent, and appropriate manner to the organization's needs.

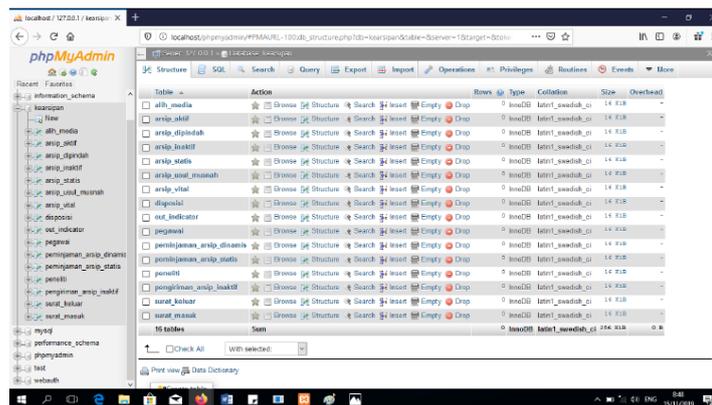


Figure 2. Archive Database in phpMyAdmin

Based on the three scientific articles analyzed, the results of this study strongly align with previous studies on the application of semantic-based technology for data and archive management [18]. Research by Prianda Dipati Bangsa and Indra Hermawan (2020) demonstrated that semantic-based web repositories can facilitate the digitization of conventional archives and provide regular and specific search features. This aligns with this study's design of an archival database with 19 integrated tables and a retention period attribute. Furthermore, research by Febriend Roni Sianipar (2024) confirms that implementing the Semantic Web is a strategic step in integrating data from various sources and improving information accuracy [19]. These findings reinforce the use of the Semantic Object Model (SOM) approach in this study to establish relationships between entities such as employees, incoming mail, dispositions, and various types of archives. Thus, the semantic approach proves relevant in creating an integrated and systematic data structure.

Similarly, research by Muhamad Sahyudi and Muhammad Ropianto (2024) confirms that a systematic system development method can produce a functional system that meets user needs. This is in line with this research, which, through three design phases conceptual, logical, and physical successfully implemented an archival database using MySQL. These three previous studies consistently support the finding that semantic-based approaches, whether through ontology, RDF, or SOM, can improve the accessibility and efficiency of data management. A deeper representation of relationships between entities allows the system to work more informatively and contextually [20]. Therefore, the model produced in this research is considered capable of supporting archival business processes more effectively and structured.

Based on an analysis of three previous studies, a significant gap was identified that this study successfully filled [21]. The studies by Prianda Dipati Bangsa and Indra Hermawan (2020) and Febriend Roni Sianipar (2024) still focused on limited domains such as academic repositories and vehicle data integration without addressing the complexity of government archives. Meanwhile, the study by Muhamad Sahyudi and Muhammad Ropianto (2024) did not yet integrate archive retention management mechanisms according to regulations. This study fills this gap by designing an archival database based on the Semantic Object Model (SOM) that produces 19 integrated tables, covering active, inactive, vital, and static archives as mandated by Law Number 43 of 2009 concerning Archives. Different from previous ontology and RDF approaches, the SOM model in this study was developed from actual forms used at the South Sumatra Provincial Archives Service, making it more appropriate to operational needs [22]. The main novelty lies in the integration of the `storage_term` attribute to support retention control according to JRA, so that this research successfully bridges the gap between semantic technology and the regulatory needs of government archive management.

This research provides important implications for the development of a government archive management system through the design of a Semantic Object Model (SOM)-based database that produces 19 integrated tables

and covers all types of archives as mandated by Law Number 43 of 2009 concerning Archives. This finding is in line with the research of Aryono et al. (2025) which states that digital archive systems are able to manage data effectively from the input stage to reporting so that administrative processes become more efficient and organized [23]. This research strengthens these findings by adding the `retention_term` attribute to support retention management according to the Archive Retention Schedule (JRA). In addition, Mulyana and Azzahra's (2025) view regarding the importance of a semantic approach in creating an easily understood logical structure is also relevant to the success of the SOM in representing relationships between archival entities [24]. Practically and theoretically, this research proves that a semantic-based approach is effective in increasing the efficiency, accuracy, and accountability of government archive management and has the potential to be replicated in other agencies with similar needs [25].

This research has several limitations that require attention for further development. First, this research has only reached the design and implementation stage of a database using MySQL, and has not yet been developed into a complete information system that can be used directly at the South Sumatra Provincial Archives Service [26]. Second, the data used is still limited to archival forms and documents obtained during the research period, thus not covering the full range of data variations in daily operations [27]. Third, the testing conducted is limited to verifying table structures and relationships between entities, without large-scale performance testing or system security testing [28]. Therefore, further research is needed in the form of comprehensive application development, implementation in a real-world user environment, and regular evaluation to ensure the designed database can adapt to the dynamics of organizational needs.

4. CONCLUSION

This research successfully designed a database system for archives management at the South Sumatra Provincial Archives Service using the Semantic Object Model (SOM) approach, thus meeting the objectives set out in the introduction to address the problems of slow archive retrieval, the high risk of archive loss, and the discrepancy between follow-up and retention schedules [29]. The design involved three phases: a conceptual phase, which identified 19 semantic objects from archival forms and reports; a logical phase, which transformed these objects into table relationships; and a physical phase, which implemented them in a MySQL database.

The design results demonstrated that the SOM approach was effective in modeling user needs because it began with an analysis of documents used in daily activities, resulting in a database structure aligned with the agency's archives management business processes [30]. The resulting database consisted of 19 interconnected tables, equipped with primary and foreign keys to maintain data integrity, and a retention period field in the `inactive_archives` and `vital_archives` tables to support the management of archive retention schedules. The development prospects of this research are that the database design can be further implemented into a complete archival information system, and can be adapted for other archival agencies at the provincial and district/city levels with adjustments according to their respective needs.

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