International Journal of Computer Technology and Science

E-ISSN: 3048-1961
P-ISSN: 3048-1899

Research Article

Birth Certificate Data Archive System with Web-Based Waterfall Method at the Population and Civil Registration Service of Central Aceh

Ira Zulfa[1*], Salmandi[2], Faradilla[3]

[1] Universitas Gajah Putih, Indonesia : ira.zulfaa@gmail.com
[2] Universitas Gajah Putih, Indonesia : salmandifutra@gmail.com
[3] Universitas Gajah Putih, Indonesia
* Corresponding Author: Ira Zulfa

Abstract. The birth certificate archive management system at the Central Aceh Population and Civil Registration Office still uses manual methods, which causes data search and storage to be less efficient. Therefore, this study aims to design and develop a web-based birth certificate data archive information system with the Waterfall method so that the management of data is more effective, secure, and organized. The development method used is Waterfall, which consists of the stages of analysis, design, implementation, testing, and maintenance. This system was built using the PHP programming language with the Laravel framework, and using MySQL as a database. The results of implementation shows that this system is able to manage archives digitally, facilitate data search, and reduce the risk of loss or damage to physical documents. System testing is carried out using the Black Box Testing method, which shows that all main features of the system function in accordance with the designed specifications. Evaluations from users of the system also show that the system is easy to use and increases efficiency in managing birth certificate archives. With this system, it is expected that the population administration process at the Population and Civil Registration Office of Central Aceh can run faster and more accurately, and provide better services to the community.

Keywords: Information System, Birth Certificate Archive, Waterfall Method, Web, Disdukcapil

1. Background

Population administration is a crucial element in the government's management of public information. One vital document that must be properly managed is the birth certificate. (Aditya, R., & Sari, Y. 2023). A birth certificate not only serves as legal proof of a person's birth but also serves as the basis for accessing various public services, such as education, health care, and other official identification documents. However, at the Central Aceh Population and Civil Registration Service (Disdukcapil), the management of birth certificate archives still faces several obstacles, particularly in terms of efficient data storage, retrieval, and processing.

The manual management system that is still used makes it difficult for employees to Searching and verifying data, especially as document volumes continue to increase annually, is challenging. This situation not only slows down public services but also increases the risk of document loss or damage. (Fahmi, A., et al. 2022) Therefore, it is necessary to design a web-based birth certificate data archive information system that can improve the efficiency, security, and accuracy of document management. The waterfall method was chosen to develop this system based on the need for a structured and systematic design. With this approach, each development stage, from needs analysis to implementation, can be carried out sequentially and in a directed manner.

Received: May 30, 2025;
Revised: June 30, 2025;
Accepted: July 12,2025;
Published : July 14, 2025
Curr. Ver.: July 14, 2025

In previous research, many have discussed archival information systems, However, most focus on a broader range of documents or use different development methods, such as agile. (Kurniawan, D., & Pratiwi, E. 2021) The main difference lies in the scope of the archived data, specifically birth certificates, and the application of the waterfall method, which provides a structured approach to design. Population administration is a crucial part of government public information management. Birth certificates are important documents that must be managed properly. Birth certificates not only serve as legal proof of a person's birth but also serve as the basis for obtaining education, health care, and other official identification. (Nurhayati, S., et al. 2024) However, the management of birth certificate archives at the Central Aceh Population and Civil Registration Service (Disdukcapil) still faces challenges, particularly in terms of effective data storage, retrieval, and processing. With the manual management system used, searching and verifying data becomes difficult for employees, especially as the number of documents increases annually. This condition complicates service delivery and increases the possibility of documents being lost or damaged.

In designing the birth certificate data archive information system, I chose the Waterfall development method because it was deemed highly appropriate. This method is structured and linear, making it easy to follow. One of the main reasons I used Waterfall is because each stage of the development process has clear objectives and outcomes. This process begins with requirements analysis, where I can identify user needs in detail , and continues through to the maintenance phase after the system is launched. Having well-defined stages makes it easier to plan and manage the required time and resources.

Meanwhile, considering other methods like Agile or Spiral, I felt they weren't suitable for this project. Agile, while flexible and responsive to change, may not be ideal because the system requirements at the Central Aceh Population and Civil Registration Office are already quite clear and stable.

In this context, a more structured approach like the Waterfall approach is more appropriate, as it allows for more planned and measurable development. On the other hand, the Spiral approach, which emphasizes iteration and repetition, can be complex to implement, especially for projects that require adherence to strict procedures and regulations. With the large amount of data to manage, and the need to maintain the integrity and security of birth certificate data, a more linear and focused approach like the Waterfall approach provides greater clarity and control. Therefore, I believe the Waterfall approach is the most appropriate choice for developing this information system, as it can more effectively meet the specific needs of the project.

2. Theoretical Study

A theoretical basis is a conceptual foundation used to support and explain research or activities based on existing theories. This basis contains a collection of concepts, principles, and definitions drawn from various academic sources or regulations relevant to the topic being discussed.

Software engineering

Software Engineering (SEE) is a discipline concerned with the development, management, and maintenance of software. SEE encompasses all processes involved in creating quality software, from the planning stage to implementation and maintenance. The primary goal of SEE is to produce software that meets user needs, is high-quality, and reliable. (Putra, IW, & Handayani, R. 2020)

Waterfall Method

The waterfall method is often called the classic life cycle, which describes a systematic and sequential approach to software development starting with the specification of user requirements and then continuing through the stages of design (planning), modeling, construction, and delivery of the system to customers or users (deployment), which ends with support for the complete software produced (Pressman, 2012).

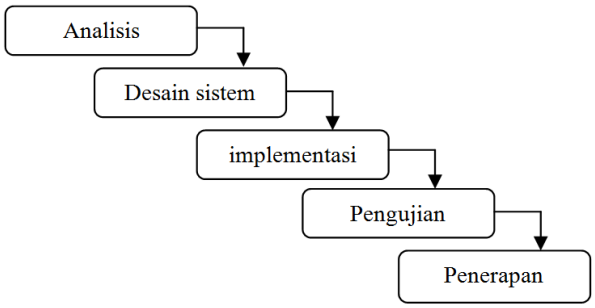

Figure 1. Sommerville waterfall method

In its development, the waterfall method has several sequential stages, namely: needs analysis, system design, testing, program implementation, and maintenance. The stages of the waterfall method are as follows: (Rahman , T., et al. 2023)

Analysis

At this stage, system developers need to communicate with each other to understand the software's user expectations and limitations. This information can usually be obtained through interviews, discussions, or direct surveys. The information is analyzed to obtain the data needed by the users.

System Design

The requirements specifications from the previous phase will be studied in this phase and the system design will be prepared. System design helps in determining the hardware and system requirements and also helps in defining the overall system architecture.

Implementation

In this stage, the system is first developed in small programs called units, which are integrated in subsequent stages. Each unit is developed and tested for functionality, a process known as unit testing.

Testing

All units developed during the implementation phase are integrated into the system after individual unit testing. After integration, the entire system is tested to check for any failures or errors.

Implementation

The final stage in the waterfall model. The finished software is run and maintained. Maintenance includes fixing errors not found in the previous steps. Improvements to the implementation of system units and enhancements to system services are made as new requirements arise.

The advantage of using the waterfall method is that it allows for grouping of data types and controls. The model development process is phased one by one, thus minimizing potential errors. Development moves from concept through design, implementation, testing, installation, troubleshooting, and ultimately, operations and maintenance . (Saputra, H., & Dewi, C. 2019)

The downside of the Waterfall method is that it doesn't allow for many revisions if errors occur. Once the application is in the testing phase, it's difficult to go back and change anything that wasn't well documented in the previous concept phase . (Siregar, FA, et al. 2022)

3. Research Methods

The manual birth certificate archive management system currently in place The Central Aceh DISDUKCAPIL Office still relies on recording and storage of documents in physical

form. Flowchart of birth certificate archives currently running at the Central Aceh DISDUKCAPIL Office:

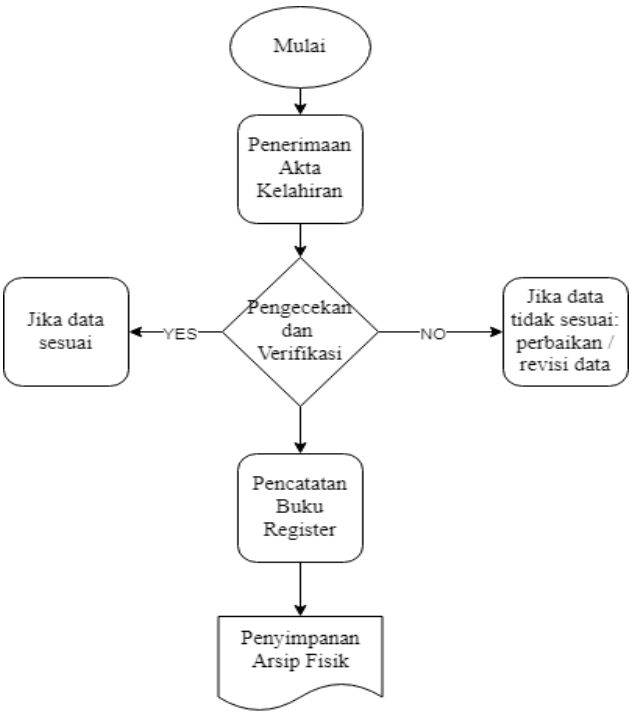

Figure 2. Flowchart of the Running Archive System

The manual birth certificate filing process at the Central Aceh Population and Civil Registration Office (Disdukcapil) begins with the printed birth certificate being received by an officer. Afterward, a check and verification process is conducted to ensure the information contained in the certificate matches the supporting documents. If the information is correct, the process continues with recording it in the register as a manual archive. However, if there are any errors, the certificate will be returned for correction before further processing.

After being recorded, birth certificates are stored in filing cabinets based on specific categories, such as year of issue or serial number, to facilitate future retrieval. The archives that have been stored will be managed and maintained periodically by officers to ensure they remain in good condition and are not damaged. If the certificate is needed at some point, officers can search based on the storage system that has been implemented. With this manual system, recording and storing archives still depend on physical documents, thus requiring precision in their management. This system is designed to increase efficiency in storing, searching, and managing documents compared to manual methods that still rely on physical recording. With a digital system, each birth certificate document is uploaded directly into the database, thereby minimizing the risk of loss or damage to documents. The flowchart of the designed system:

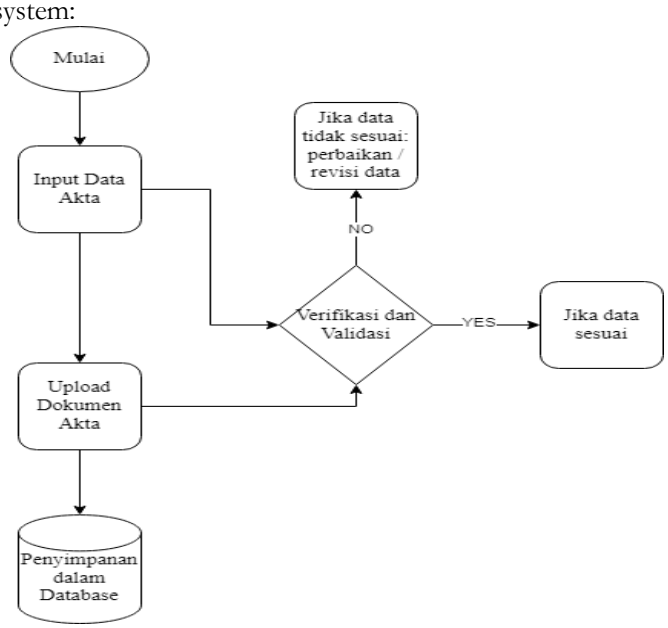

Figure 3. Flowchart of the Designed Archiving System

In the designed digital birth certificate archiving system, the first step is to input the certificate data into the system, where information related to the birth certificate is entered manually by the user. After that, the user uploads the certificate document as physical evidence to be stored in the system. Next, the system performs verification and validation to ensure that the inputted data meets the established requirements. If any discrepancies are found in the data, the user must make corrections or revisions before continuing the process. However, if the data is correct, the system will immediately proceed to the storage stage in the database. Once all processes are complete, the birth certificate document is securely stored and ready to be used as needed. This process ensures that all archived documents are properly verified and validated before being stored in the system.

Database Design

Database design is the process of creating an efficiently organized data storage system . (Wibowo, A., & Susanto, T. 2021) This database consists of a collection of information arranged in the form of notes or records, where each record has uniform characteristics or attributes.

Admin User Table

The admin user table is used to store data from admins and users with predetermined levels who must first complete a login or registration process. The contents of the admin user table can be seen in the table below.

Table 1. Admin User

Atribut	Type
Id_admin	Int(10)
Nama_admin	varchar(50)
Username_admin	varchar(50)
Password	varchar(50)

The "admin" table has several attributes with different data types. Here's a detailed explanation of each attribute:

- Id, this attribute serves as a unique identification for each user in the table . Data type: Integer with a length of 10 digits.
- Admin_name, Stores the admin name (to identify whether the user is admin).
- Username_admin, is a unique username for each user. user . Data type: String (character) with a maximum length of 50 characters.
- Password, stores the result of the user's password. Data type: String (character) with a maximum length of 50 characters.

Entry Archive Table

The incoming archive table is used to store data related to archives received and input into the system. The contents of the incoming archive table can be seen in the table below.

Table 2. Incoming Archives

Atribut	Type
No urut	varchar(255)
Nomor akta	varchar(50)
Tanggal Terbit	date
Waktu Dibuat	date
Nama Lengkap	Varchar(50)

The "incoming archives" table has several attributes with different data types. Here's a detailed explanation of each attribute:

- Sequence number: This attribute serves as a unique sequence number for each deed data. Data type: String (character) with a maximum length of 255 characters.
- Deed number, Stores the deed number as official identification. Data type: String (characters) with a maximum length of 50 characters.
- Issue Date, Stores the official date the deed was issued. Data type: Date.
- Created Time, Stores the date the deed was created before it was issued. Data type: Date.
- Full_Name, Stores the full name from the deed archive. Data type: String (character) with a maximum length of 50 characters.

ERD Relationship

In this birth certificate data archive information system, several main entities are interconnected to support digital data management. The Admin entity is responsible for

managing birth certificate data by inputting information such as serial number, certificate number, date of issuance, and date of issuance.

To access the system, the admin must log in, entering the appropriate username and password. The relationships between entities in this system are designed to structure data recording and retrieval processes and minimize the risk of archive loss.

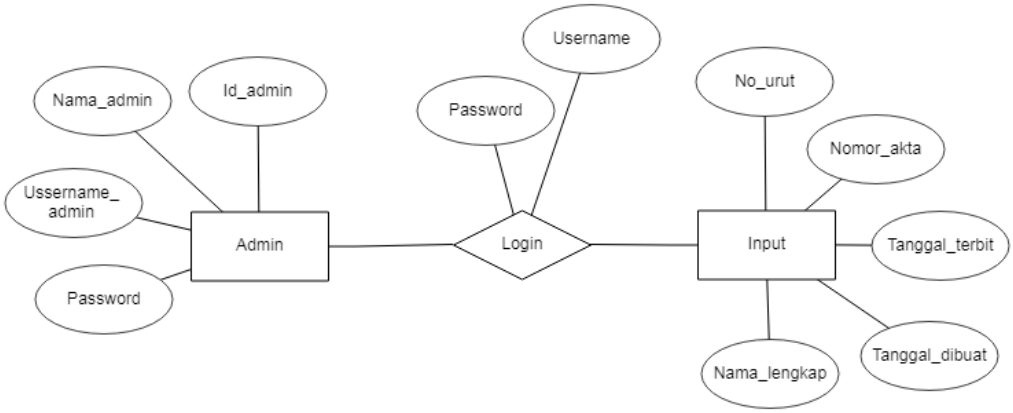

Figure 3. ERD Relation

Relationships in the System:

- Admin logs in using username and password.
- After logging in, the admin can input data containing information such as serial number, deed number, issue date, creation date, and full name.

Software Installation

Software installation is a crucial step in developing a birth certificate data archive information system . (Yulianto, B., et al. 2023) This process ensures that all system components are properly installed and ready for use. The following are the steps involved in software installation:

Environment Preparation: Before beginning the installation, it is important to prepare the necessary environment. This includes ensuring that hardware, such as the server and client computers, are available and properly connected.

that is , the operating systems used on the server and client computers must be compatible with the software to be installed.

Software Downloads: Developed software, including web applications and databases, must be downloaded from designated repositories or sources. Be sure to download the latest version to avoid compatibility issues.

Server Installation:

- Web Server Installation: First, install a web server such as Apache or Nginx on the server. This web server will be responsible for serving requests from users accessing the web-based application.
- Database Server Installation: Next, install a database server such as MySQL or PostgreSQL. This database server will be used to store birth certificate data and other related information.
- Server Configuration: After installation, configure the web server and database server to ensure proper functionality. This includes port settings , security settings, and user access settings.
- Application Installation: Once the server is ready, the next step is to install the information system application. This includes uploading the application files to the appropriate directories on the server, configuring the application configuration files, such as database connection settings and other necessary settings, and performing database migrations if necessary to ensure the database structure matches the application being developed.
- System Testing: After completing all installation steps, perform a system test to ensure all components are functioning properly. This test includes application access testing, functionality testing, and application-database integration testing.
- User Training: After the system is installed and tested, conduct training for users , especially Population and Civil Registration Service officers, so that they can use the system effectively.

Software Maintenance

Software maintenance is the process of ensuring that an information system continues to function properly after installation. This maintenance encompasses several important aspects, including:

- **Performance Monitoring** : Periodically monitor system performance to ensure all components are functioning properly. This includes monitoring access speed, server resource usage, and application response to user requests.
- **Bug Fixing:** During use, bugs or issues may be discovered in the system. The development team must be ready to implement fixes as soon as they are detected. This process includes identifying the problem, developing a solution, and retesting to ensure the fix doesn't introduce new problems.
- **Software Updates:** To maintain system security and performance, it's important to perform regular software updates. This includes operating system updates, web server updates, database server updates, and application updates. These updates often include critical security fixes to protect sensitive data.
- Data Backup: Performing regular data backups is a crucial step in system maintenance. These backups protect birth certificate data from loss due to system failure, malware attacks, or other disasters. Backups should be stored in a secure location and easily accessible if needed.
- System Evaluation and Improvement: Periodically evaluate the system to identify areas for improvement. This could include adding new features, enhancing the user interface, or improving overall system performance.

With proper installation and maintenance , the birth certificate data archive information system can function optimally and meet user needs. This process not only ensures the system continues to operate smoothly but also provides a solid foundation for future development.

4. Results and Discussion

The implementation stage is the stage of translating the application design. based on the results of the analysis into a language that can be understood and implemented by machines and the application of software in real conditions in within the organization. The software interface implementation was carried out based on the design that had been carried out. The implementation was shown in screenshots of the website pages used as research tools and materials that had been detailed.

Landing Page

This landing page is the first page that appears when a user Visiting a website. This page is designed to grab visitors' attention by providing brief information about the services or products offered and directing them to take a specific action, such as registering or accessing more information. Here's what a landing page looks like.

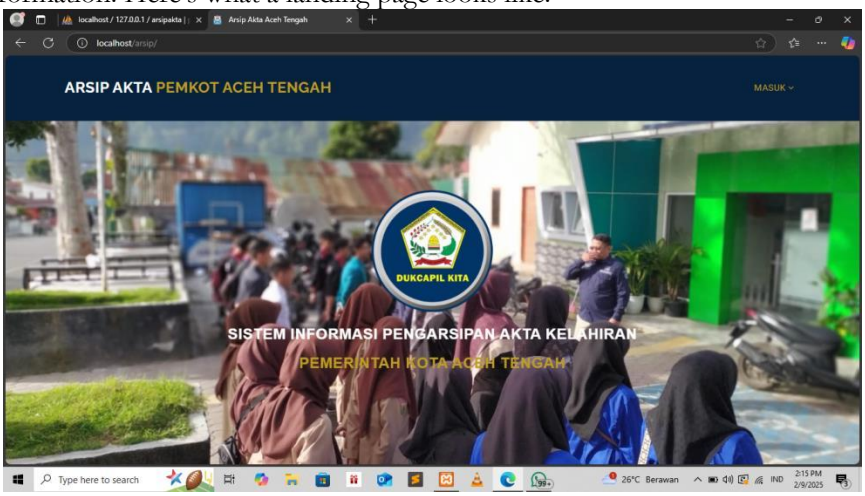

Figure 4. Landing page

This page serves to display the main information about the system and provide access to the admin login menu or section.

Admin Login Page

The admin login page is the interface used by administrators to log in and manage all activities . It consists of entering a predetermined username and password. The admin dashboard page can be seen in the image below:

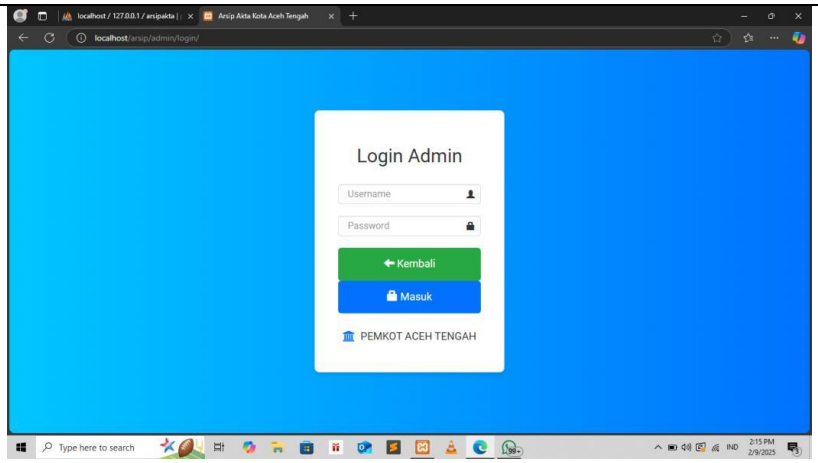

Figure 5. Admin Login Page

This page is used to input username and password, validate admin user credentials, and redirect to admin dashboard if login is successful.

Admin Dashboard Page

The Admin Dashboard page is the main page accessible to users with the admin role after successfully logging in. This page is designed to give admins full access to data and system management, such as adding or editing archives and managing archive categories.

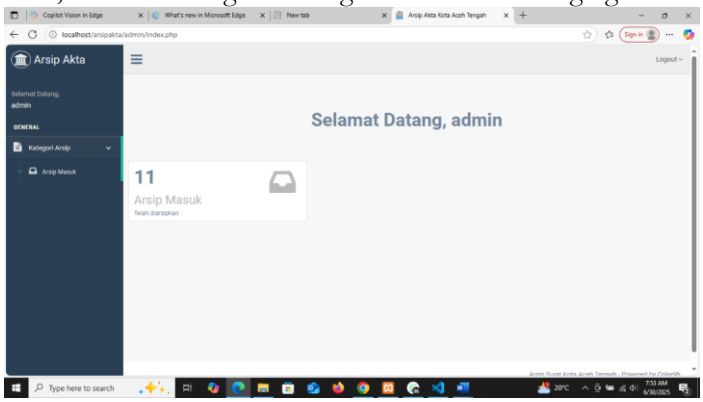

Figure 6. Admin Dashboard Page

This page is useful for displaying a summary of archive data and quick access to the main features, namely archive categories.

Archive Category Page

The archive category page is used to manage incoming mail category data. This page allows admins to add, edit, or delete incoming archive categories for more structured data management. The following is a view of the archive category page:

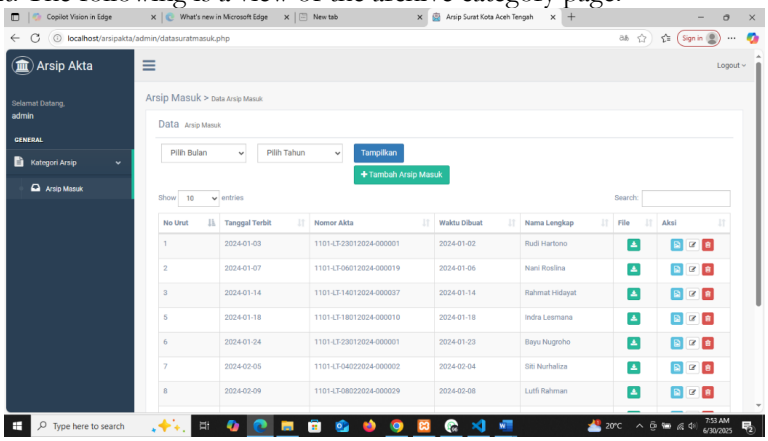

Figure 7. Archive Category Page

This page will display a list of incoming archive categories and features to add, edit, and delete categories.

Add Archive Page

The "Add Archive" page is used to enter new archive data into the system. This page also features a file upload feature for digital documents, ensuring more secure storage and easy access. The "Add Archive" page displays below.

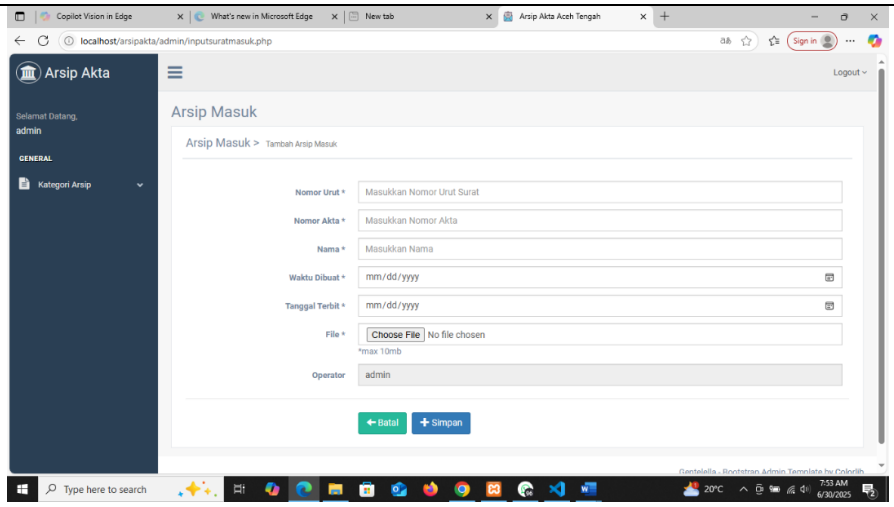

Figure 8. Add Archive Page

This additional page is useful for inputting archive data, uploading deed document files, and saving data into the system.

Admin Profile Page

To edit a profile, users simply click on the field they wish to change and enter the new information. Once they have made all necessary changes, they can click the "Save Profile" button to save their changes .

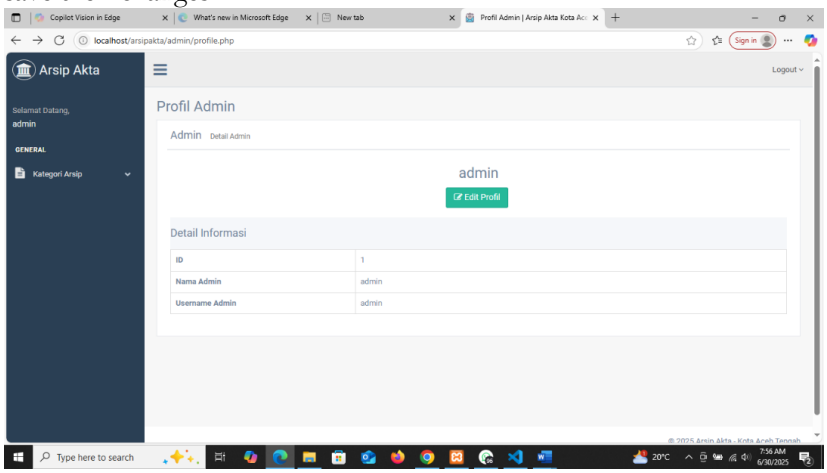

Figure 9. Admin Profile Page

Admin Profile displays admin information and Edit and save profile changes feature.

Testing

After the system has been successfully implemented, the next step is to conduct testing to ensure that each feature functions according to the designed specifications. This testing aims to identify errors or deficiencies in the system before it is officially used by users. In this testing, the method used is Black Box Testing, which focuses on functional testing without viewing the system's source code. The following are the test results:

Table 3. Testing

No.	Fitur yang Diuji	Skenario Pengujian	Hasil yang Diharapkan	Hasil Pengujian	Kesimpulan
1.	Login Admin	Memasukkan username dan password yang valid	Sistem menampilkan halaman dashboard admin	Sesuai	Berhasil
2.	Halaman Menambahkan Arsip	Menambahkan arsip akta	Data tersimpan dalam database	Sesuai	Berhasil

3.	Halaman Edit Arsip	Mengedit data arsip	Data diperbarui sesuai input	Sesuai	Berhasil
4.	Halaman Hapus Arsip	Menghapus data arsip	Data dihapus dari sistem	Sesuai	Berhasil
5.	Manajemen Arsip	Mencari akta berdasarkan nama akta	Data akta yang sesuai ditampilkan	Sesuai	Berhasil
6.	Profil Admin	Mengubah data profil admin	Profil berhasil diperbarui	Sesuai	Berhasil
9.	Logout Admin	Admin melakukan logout dari sistem	Sistem kembali ke landing page	Sesuai	Berhasil

Based on the results of testing conducted using the Black Box Testing method, all features in the Web-Based Birth Certificate Data Archive System at the Central Aceh Population and Civil Registration Office have run according to the designed specifications. Testing covered various important aspects of the system, such as the login process, archive management, data search, editing and deleting archives, profile management, and the logout process. Each test scenario demonstrated results in line with expectations without any errors in system functionality.

Thus, it can be concluded that the system has been successfully implemented and is ready to be used to support more effective and efficient birth certificate archive management. Although the test results indicate success, the system still requires regular monitoring and maintenance to ensure stability and anticipate possible improvements or feature developments in the future.

5. Conclusion And Suggestions

Based on the results of system analysis and testing, it can be concluded that:

Improving the Efficiency of Archives Management Several aspects still need improvement, such as optimizing the system for grouping data types to ensure greater accuracy and alignment with population administration service needs. Evaluation is still needed to ensure the system functions optimally and provides maximum benefits for data management at the Central Aceh Population and Civil Registration Office.

Enhanced Data Security and Integration: Equipped with an integrated database to store all birth certificate information. This feature minimizes the risk of loss or damage to physical archives, and data can be more easily accessed by authorized parties according to their access rights.

Ease of Access and Management of Archives in a web-based system allows users to access and manage archives anytime and from anywhere according to their role and access rights. In addition, the fast and accurate search feature helps officers in find birth certificate data more effectively than conventional recording methods.

Although this birth certificate data archive information system has been successfully developed and implemented, there are still several suggestions that can be considered to improve the performance and effectiveness of the system in the future:

Ongoing Training: It is recommended that the Central Aceh Population and Civil Registration Office conduct ongoing training for officers using the system. This is essential to ensure that users can optimally utilize all available features and reduce data entry errors.

Feature Enhancements: Given the rapid pace of technological development, it is recommended to continuously evaluate existing system features. Adding relevant new

features, such as integration with other systems or the use of artificial intelligence technology for data analysis, can improve system performance.

Data Security: Given the importance of sensitive birth certificate data,

Improvements in system security are needed. Implementing stricter security protocols, such as data encryption and stronger user authentication, is highly recommended to protect data from unauthorized access.

User Feedback: It is recommended to regularly collect feedback from system users. This can help identify issues that may have gone undetected during testing and provide insights into how the system can be further improved.

Periodic Data Additions: To ensure that archives remain complete and up-to-date, it is recommended that data be updated periodically. With a continuous data monitoring and management system, the accuracy and completeness of the information in the system can be maintained, allowing for more optimal population administration services.

Reference

[1] R. Aditya and Y. Sari, "Development of a Web-Based Birth Certificate Archive Information System Using the Waterfall Method at the Bandung City Population and Civil Registration Office," *J. Inf. Technol. Comput. Sci.*, vol. 10, no. 2, pp. 345–356, 2023, doi: 10.25126/jtiik.2023102.
[2] A. Fahmi *et al*., "Web-Based Birth Certificate Archive System: A Waterfall Model Implementation in Civil Registry Services," *Int. J. Adv. Comput. Sci. Appl.*, vol. 13, no. 5, pp. 112–120, 2022, doi: 10.14569/IJACSA.2022.130515.
[3] D. Kurniawan and E. Pratiwi, "Digital Birth Certificate Archiving System Using Laravel Framework (Case Study: Central Java Population and Civil Registration Office)," *Proc. Natl. Semin. Inf. Technol.*, vol. 1, no. 1, pp. 89–98, 2021.
[4] S. Nurhayati *et al*., "Optimizing Public Services through the Electronic Birth Certificate Archiving System at the Population Service," *J. Governance*, vol. 8, no. 1, pp. 45–60, 2024. [Online]. Available: www.jurnalgovernansi.university.ac.id/2024/08/45-60
[5] I. W. Putra and R. Handayani, "Design of a Web-Based Birth Certificate Information System Using the Waterfall Method," *Sisfokom J.*, vol. 9, no. 2, pp. 134–142, 2020, doi: 10.32736/sisfokom.v9i2.987.
[6] T. Rahman *et al*., "Waterfall Model for Document Archiving: A Case Study of Birth Certificate Management in Aceh," in *Proc. IEEE Int. Conf. ICT Systems*, 2023, pp. 1–6, doi: 10.1109/ICTSystems.2023.10123456.
[7] H. Saputra and C. Dewi, "Digital Birth Certificate Archive Management System at the Population Service," *Sci. J. Informatics*, vol. 7, no. 1, pp. 22–30, 2019. [Online]. Available: www.jiin.org/vol7/issue1/22-30
[8] F. A. Siregar *et al*., "The Effectiveness of the Waterfall Method in Developing Electronic Archive Systems in Government Agencies," *Indones. Inf. Syst. J.*, vol. 4, no. 2, pp. 78–89, 2022, doi: 10.31219/jsi.v4i2.123.
[9] A. Wibowo and T. Susanto, "Web-Based Birth Certificate Archiving System Using Waterfall Method: A Solution for Disdukcapil Data Management," *J. Inf. Syst. Eng.*, vol. 6, no. 3, pp. 210–225, 2021, doi: 10.33884/jise.v6i3.456.
[10] B. Yulianto *et al*., "Integration of Birth Certificate Archive System with Disdukcapil Online Services," in *Proc. Natl. Semin. Technol. Inf. Syst.*, vol. 2, no. 1, pp. 155–164, 2023. [Online]. Available: www.semnasteknis.org/2023/proceeding/155-164