Journal of Artificial Intelligence and Engineering Applications

Website: https://ioinformatic.org/

June 2026. Vol. 5. No. 3; e-ISSN: 2808-4519

Design and Development of a News Website and CMS Based on Three-Tier Architecture: A Case Study of PLTU Pangkalan Susu

Zainuddin[1]*, Veri Ilhadi[2]

[1, 2] *Information Systems Study Program, Faculty of Engineering, Malikussaleh University*
zainuddinlsw96@gmail.com [1*], veri@unimal.ac.id [2]

Abstract

Pangkalan Susu Steam Power Plant does not yet have a structured official publication platform, causing information dissemination to depend mainly on social media and making news archives difficult to organize and retrieve regularly. This condition highlights the need for a web-based information system that supports more professional content management. This study aims to design and develop a news website and Content Management System (CMS) by applying a Research and Development (R&D) approach and three-tier architecture, which separates the presentation layer, application logic layer, and data layer. The development process consists of requirements analysis, system architecture and database design, implementation, and functional testing. The system was implemented using Laravel as the application framework, Blade for the user interface, Filament as the administration panel, and MySQL as the database management system. Functional testing was conducted using the black-box method on 14 main scenarios, including the management of news, categories, authors, banners, and logout features. The results show a 100% success rate, indicating that all tested functions operated according to the expected outcomes without functional errors. The proposed architecture produces a modular, scalable, and maintainable system that can support the future development of the official information platform of Pangkalan Susu Steam Power Plant.

Keywords: *web-based information system; content management system; three-tier architecture; Laravel; black-box testing*

1. Introduction

The transformation of organizational services and communication systems increasingly relies on digital channels that are able to deliver information quickly, structurally, and in a well-documented manner. In the context of institutions or organizations, the use of website-based information systems supports the provision of information and services more effectively because content can be managed and accessed by the public without limitations of space and time [1]. However, when information distribution depends only on social media or ad-hoc channels, information tends to become scattered, difficult to retrieve, and lacks consistent content quality control.

For a news portal, website quality is not merely related to visual appearance, but also to usability, information quality, and service interaction quality, all of which ultimately influence user satisfaction. A study evaluating news portals using WebQual 4.0 and the Importance Performance Analysis approach shows that improvements in these dimensions need to be prioritized so that user expectations can be fulfilled [2]. This finding emphasizes the importance of developing a news portal with clear navigation, accurate and up-to-date information, and a reliable content management mechanism.

From an implementation perspective, the need for dynamic news management requires a Content Management System (CMS) module that supports publication workflows, access control, and change recording through an audit trail. Development using a modern framework is also necessary to accelerate feature construction, maintain architectural consistency, and simplify system maintenance. Laravel, for instance, is widely used in web application development because it provides a systematic development structure and adequate ecosystem support [3].

To improve system maintainability, a layered architectural design becomes a relevant approach. The implementation of a three-tier architecture separates the presentation layer, application logic layer, and database layer, making it easier to manage system changes and improve scalability[4]. The use of Laravel and MySQL has also been reported as effective in web-based application development [5]. Based on these considerations, the news portal and CMS modules can be developed in a more controlled manner, particularly in managing data, APIs, and user interfaces.

In addition to architectural aspects, the quality of user experience must also be ensured through UI/UX design that is oriented toward user needs. The design thinking approach emphasizes an iterative process consisting of empathize, define, ideate, prototype, and test stages to validate design solutions, so that interaction planning can better align with user contexts and behavior [6], [7].

At the quality assurance stage, functional testing is an essential practice to ensure that each feature operates according to its specifications. Black-box testing, including the equivalence partitioning technique, is used to validate system outputs based on input scenarios without

examining the internal code structure. This method is effective for identifying functional errors and ensuring that the developed system meets the expected requirements.

2. Theoretical basis

2.1. Website-based information system

A website-based information system is a digital system designed to collect, process, store, and present information through internet-based access. In organizational and institutional contexts, this system supports more efficient information delivery because data can be managed centrally and accessed by users without being limited by time and location. The use of a website-based system also helps reduce dependence on manual documentation and scattered communication channels. Previous studies on web-based information systems indicate that digital systems can improve information management, simplify data retrieval, and support more structured organizational services [7]. This concept is relevant to the development of the news website at Pangkalan Susu Steam Power Plant because the system is intended to serve as an official publication medium and digital archive.

2.2. News website

A news website is a web-based platform used to publish news, announcements, and other information in a structured digital format. In contrast to social media, which tends to prioritize real-time interaction, a news website provides better control over content organization, categorization, searchability, and publication consistency. The quality of a news website is not only determined by its visual design, but also by usability, information quality, service interaction, and user satisfaction. Studies on online news portals using WebQual 4.0 show that usability, information accuracy, and interaction quality are important dimensions in evaluating the performance of a news portal [8], [9]. Therefore, the public website developed in this study needs to provide clear navigation, updated information, and accessible content so that visitors can obtain news effectively.

2.3. Content Management System (CMS)

A Content Management System (CMS) is a system that enables administrators to create, edit, delete, organize, and publish digital content through an administration interface. In a news website, CMS plays an essential role because it allows content management to be performed dynamically without requiring direct modification of the source code. The CMS also supports structured publication workflows, access control, and content consistency. Previous research on website-based content management systems shows that CMS development using Laravel and MySQL can support content organization, application evaluation, and system management more effectively [10]. In this study, the CMS is used to manage news articles, categories, authors, and banners so that institutional publication activities can be carried out in a more systematic manner.

2.4. Three-tier architecture

Three-tier architecture is a software architecture model that separates the system into three main layers, namely the presentation layer, the application or business logic layer, and the data layer. The presentation layer is responsible for displaying information to users, the application layer manages business processes and system logic, while the data layer handles data storage and retrieval. This separation allows each layer to have a clear responsibility, making the system easier to maintain, test, and develop further. In the context of web application development, a layered architecture also supports modularity and scalability because changes in one layer can be managed without directly affecting the entire system. This concept is in line with modern web development practices that emphasize separation of concerns between the user interface, backend logic, and database management [4], [11].

2.5. Supporting technologies: Laravel, Filament, Blade, MySQL, and Eloquent ORM

The implementation of the system in this study uses several supporting technologies that correspond to the three-tier architecture. Laravel is used as the main web application framework because it provides structured development features, such as routing, controllers, validation, authentication, and database integration. Blade functions as the template engine for presenting dynamic content on the public website. Filament is used as the administration panel to simplify CMS development, particularly for managing CRUD operations. MySQL serves as the database management system for storing news, categories, authors, and banner data. Meanwhile, Eloquent ORM supports data access by representing database tables as models, making queries and data manipulation processes more organized. Previous studies on Laravel-based web development and Laravel Filament-based CMS implementation indicate that these technologies can support modular, maintainable, and structured web application development [11], [12].

2.6. UML modeling

Unified Modeling Language (UML) is a modeling approach used to visualize system requirements, workflows, interactions, and data structures before implementation. UML diagrams help developers and stakeholders understand how the system works and how each component relates to other components. In system development, use case diagrams are commonly used to describe the interaction between actors and system functions, activity diagrams explain the flow of activities or processes, and class diagrams illustrate the structure of data and relationships between objects. The use of UML is relevant in this study because the system involves different actors, namely administrators and visitors, as well as several core modules such as news, categories, authors, and banners. By using UML, the system design can be represented more clearly and the risk of misinterpretation during implementation can be reduced [7], [13].

2.7. Black-box testing

Black-box testing is a software testing method that focuses on validating system functionality based on input and output without examining the internal structure of the source code. This method is suitable for testing whether each feature operates according to the specified requirements. In web application development, black-box testing is commonly applied to verify functions such as login, data input, data update, data deletion, search, filtering, and logout. Previous research shows that black-box testing, including boundary value analysis and

equivalence partitioning, is effective for identifying functional errors and evaluating whether system outputs match the expected results [14]. In this study, black-box testing is used to evaluate the main functional scenarios of the news website and CMS, including administrator login, content management, banner management, search features, and logout functionality.

3. Research Methods

3.1. Research Stages

This study uses a system design and development approach to produce a news website and Content Management System (CMS) as an institutional publication medium and digital archive. The workflow is arranged in several stages, starting from information collection, requirements analysis, architectural and database design, implementation, and functional testing. This staged development model is commonly applied in web-based system and service application development, as it helps ensure that user requirements are identified from the beginning and that functional validation can be carried out in a measurable manner at the final stage [15], [16], [17]. Figure 1 presents the stages of the system development process.

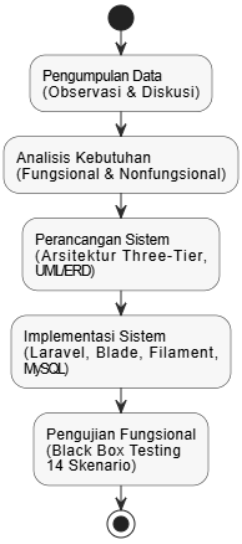

Fig. 1: Table Flow of System Development Stages

3.2. Data Collection and Requirements Identification

Data collection was conducted to obtain an overview of the business process for information publication and the required content management mechanism. The techniques used included observation of the existing publication workflow and focused discussions or interviews with relevant stakeholders to identify content requirements, information structure, and user roles, such as administrators or content managers and visitors. Data collection practices through observation and direct interaction with stakeholders are commonly applied in the development of web-based service systems to ensure that feature planning and workflow design are aligned with operational needs [17], [18].

3.3. System Requirements Analysis

The results of data collection were then formulated into system requirements, which were grouped as follows:

1. Functional requirements, namely the core functions that must be provided by the system. These include news content management through the CMS, such as news management and other related content management features, as well as user access functions, including authentication and session management such as logout. Table 1 presents the functional requirements for the website to be developed.

Table 1: System Functional Requirements

Code	Actor	Function	Brief Description
F01	Admin	Login	Admin authentication to access the CMS
F02	Admin	Manage News	Add, edit, and delete news articles with thumbnails
F03	Admin	Manage Categories	Add, edit, and delete categories
F04	Admin	Manage Authors	Add and edit author data
F05	Admin	Manage Banners	Add, activate, and deactivate banners
F06	Visitor	View News	Access the news list and news details
F07	Visitor	Search/Filter	Search news by title, category, or author
F08	Admin	Logout	End the admin session

2. Non-functional requirements, namely supporting aspects such as maintainability, component separation, and ease of future development. Table 2 presents the non-functional requirements for the website to be developed.

Table 2: Non-functional System Requirements

Code	Aspect	Criteria	Indicator/Measure
NF01	Maintainability	Modular structure	Clear separation of tiers and CMS modules

NF02	Reliability (functional)	Core features operate properly	Passes black-box testing on core scenarios
NF03	Basic usability	Clear navigation	Visitors can easily find news content
NF04	Basic security	Admin access control	CMS pages can only be accessed after login

At this stage, the main actors and system boundaries were also defined to prevent uncontrolled expansion of the system scope. A requirements analysis approach based on user roles or actors and the mapping of core functions is widely applied in web application development, as it helps translate system requirements into a clear module design [19], [20].

3.4. Architectural and Database Design

The design stage focuses on two main aspects, namely:

1. System architecture, in which the system was designed using a three-tier architecture that separates the presentation layer, application or logic layer, and data layer. This separation aims to improve modularity, simplify testing, and support future feature development, as each layer has a more clearly defined responsibility [4].

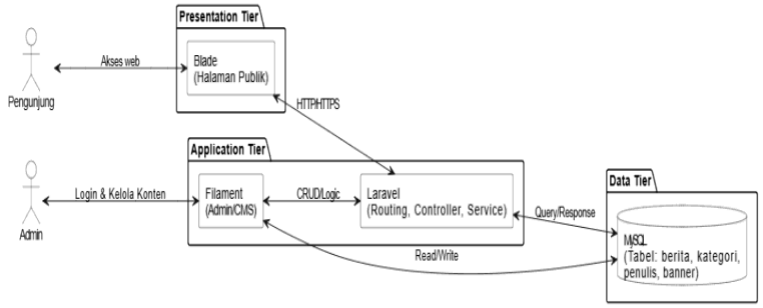

Fig. 2: Three-Tier Architecture of the News Website and CMS

2. Process and data design, in which the process and data structures were visualized using system modeling, such as use case diagrams and/or activity diagrams, to describe actor interactions with the system and the main activity flows. The database design was developed based on the required entities, such as categories, authors, and other supporting components, as well as the relationships between tables. This design ensures that the data storage structure remains consistent and supports CRUD operations in the CMS. The use of UML modeling and structured data organization to support information management is commonly applied in web-based information system development [16], [19], [20]. The interaction between the user and the system will be depicted in Figure 3 below.

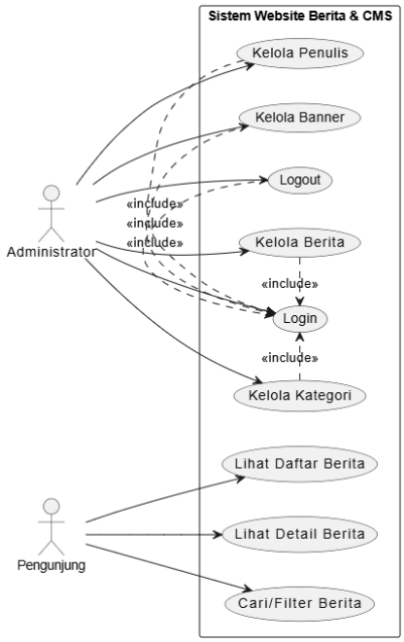

Fig. 3: Usecase diagram

User activities will be depicted in the following activity diagram image.

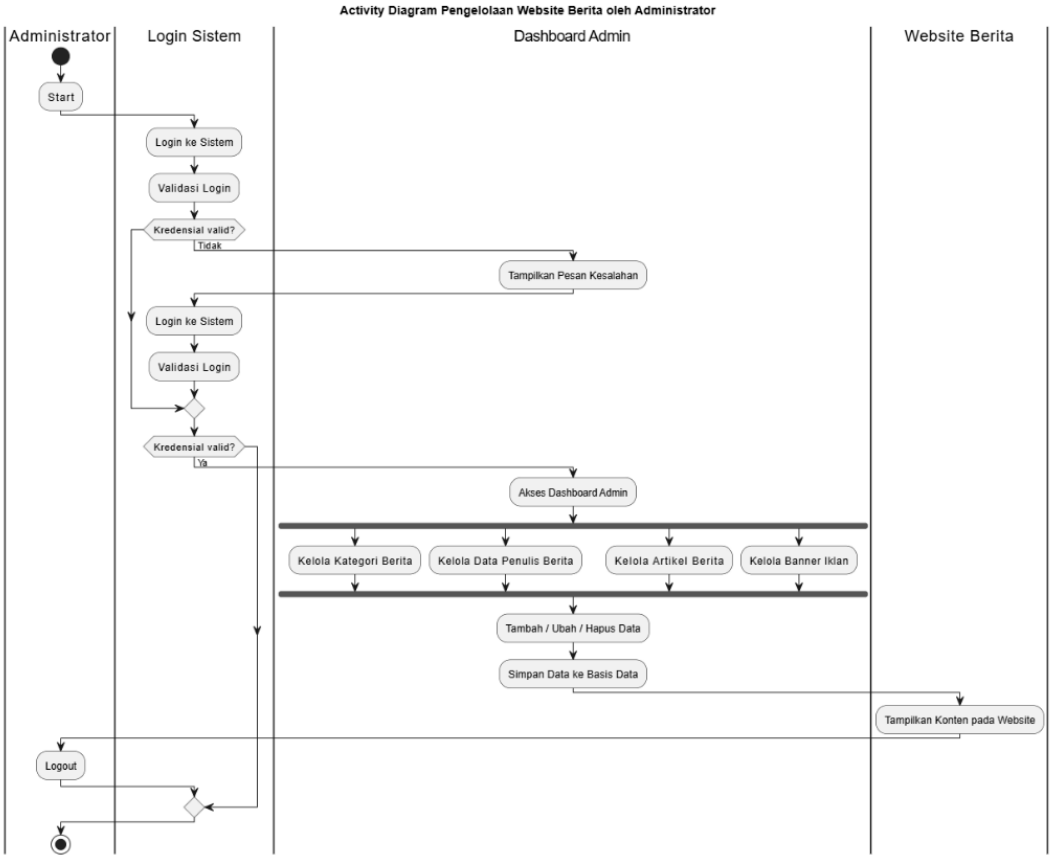

Fig. 4: Activity diagram

The database structure and relationships will be depicted in Figure 5 below.

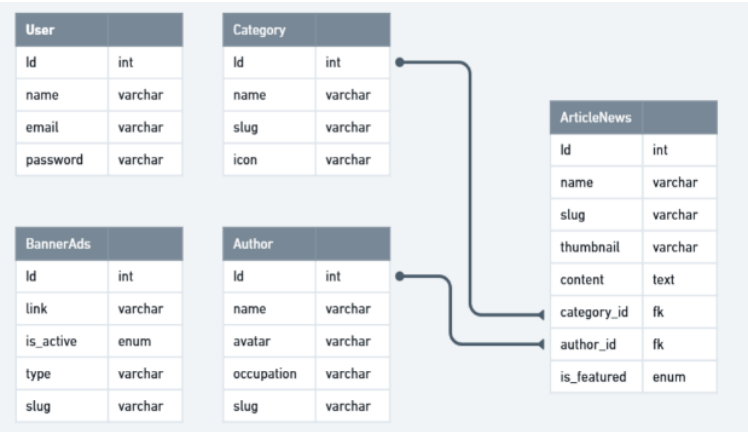

Fig. 5: Class diagram

3.5. System Implementation

The system implementation stage transforms the design plan into an executable system. In this study, the implementation was carried out by mapping each layer of the three-tier architecture to the technologies used, as presented in Table 3.

Table 3: Mapping of Components to Three-Tier Layers

Layer	Technology	Role
Presentation Tier	Blade	Displays news content to visitors
Application Tier	Laravel	Handles business logic, routing, controllers, and validation
Application Tier (CMS)	Filament	Manages CRUD operations for content, including news, categories, authors, and banners
Data Tier	MySQL	Stores data and manages relationships
Data Access	Eloquent ORM	Performs queries and data manipulation through models

The implementation of a web-based system using a framework, component separation, and feature organization within an administration panel is a common approach in the development of service applications and web-based information systems [3], [17].

3.6. System Testing

System testing was conducted using black-box testing on the main functional scenarios, with a focus on evaluating the relationship between input, process, and output without examining the internal code structure. This approach is relevant to ensure that each core function of the system operates according to the specified requirements. Previous literature on black-box testing indicates that test case-based evaluation is effective for verifying system functionality and identifying output mismatches against predefined requirements [15], [21].
In this study, testing focused on 14 test scenarios representing the core system functions, including news management, category management, author management, advertisement banner management, search features, and logout functionality. It should be noted that several studies also include user acceptance evaluation, such as User Acceptance Testing (UAT), or usability measurement, such as the System Usability Scale (SUS), to complement the assessment of user acceptance and user experience. However, this study limits the testing scope to the main functional aspects, while usability, performance, and security evaluations are recommended as future work [22].

4. Results and Discussion

4.1 System Implementation Results

The system implementation produced two main components, namely a public website for presenting news information and an administrator panel or CMS for managing content. Architecturally, the public module functions as the presentation layer that displays content using Blade, while content management is handled through Filament as the administrative interface within the application layer. News data, categories, authors, and banners are stored in the MySQL database, allowing any changes made through the CMS to be reflected on the public website.

1. Admin Dashboard Interface

The CMS dashboard presents summary information, such as the number of news articles, visitor statistical analysis, and publication status. Through the available menus, the administrator can efficiently manage news articles, categories, and media. The interface design is kept simple to facilitate navigation and minimize input errors.

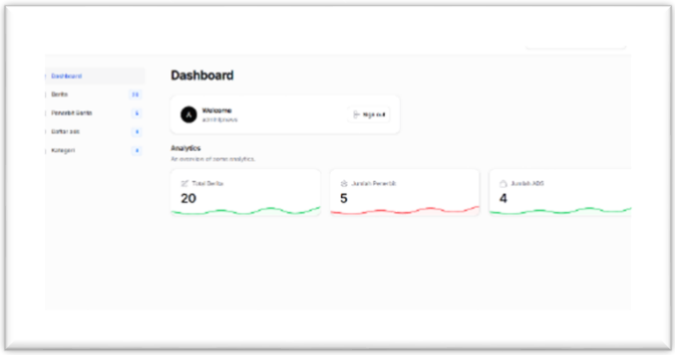

Fig. 6: CMS Administrator Dashboard (Filament)

2. Public Website Homepage Interface

The homepage of the public website displays featured news, news categories, and a search feature. Visitors can browse the latest news, select specific categories, or search for news articles using keywords. The interface is designed to be responsive so that it can be accessed across various devices.

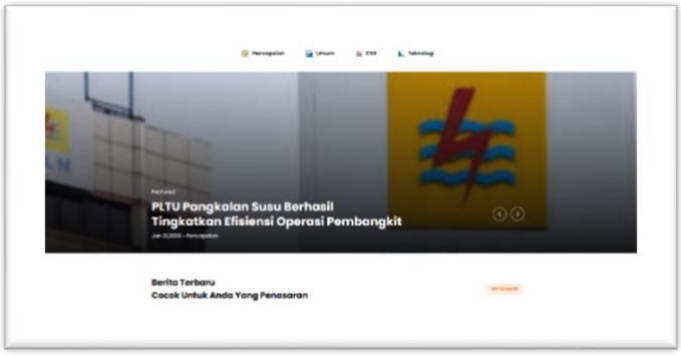

Fig. 7: Public Website Homepage

3. News Detail Page Interface

The news detail page presents complete information for each article, including the title, news content, supporting images, and related metadata. Visitors can read the information in detail and navigate to other news articles through categories or related links.

Fig. 6: News Details Page

4. Filter Interface by Author and Category

The system provides a filtering feature to help visitors search for news articles based on author or category.

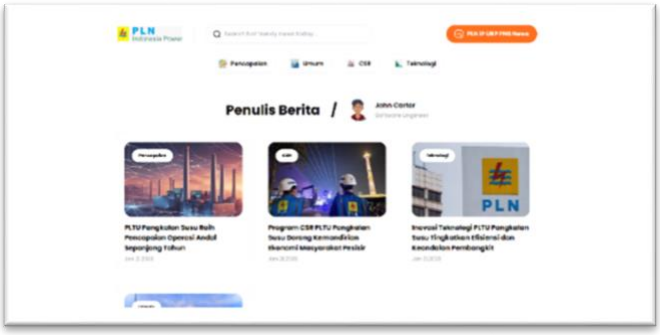

Fig. 9: Filter Interface by Author

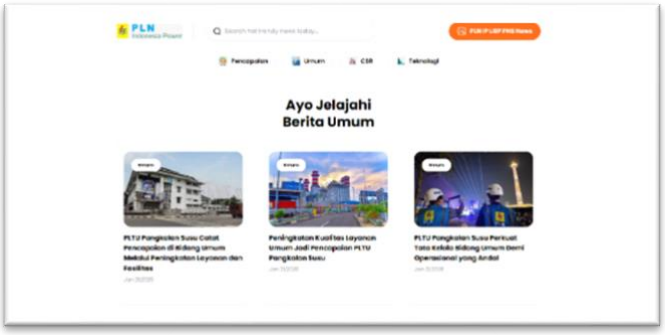

Fig. 10: Filter Interface by Category

4.2 Functional Testing Results (Black-box Testing)

Functional testing was carried out using a black-box testing approach on the core system functions based on predefined usage scenarios. The testing focused on the administrator module, including login, news management, category management, author management, banner management, and logout, as well as the public module, including search or browsing features and content display. Based on the testing conducted across 14 scenarios, all system outputs were consistent with the expected results, and each scenario was declared successful. A summary of the testing results is presented in Table 4.

Table 4: Black-box Testing Results

No.	Tested Feature	Test Scenario	Input	Expected Output	Result	Status
1	Administrator Login	Valid email and password	Valid email and password	Admin dashboard is displayed	As expected	Successful
2	Administrator Login	Invalid email/password	Incorrect email/password	Error message is displayed	As expected	Successful
3	Category Management	Add a new category	Category name	Category data is saved	As expected	Successful
4	Category Management	Edit category	New category name	Category data is updated	As expected	Successful
5	Category Management	Delete category	Select category	Category data is deleted	As expected	Successful
6	Author Management	Add author	Name, avatar, position	Author data is saved	As expected	Successful
7	Author Management	Edit author	New author data	Author data is updated	As expected	Successful

8	Article Management	Add article	Title, content, category, author	Article is saved and displayed	As expected	Successful
9	Article Management	Edit article	New article data	Article is updated	As expected	Successful
10	Article Management	Delete article	Select article	Article is deleted	As expected	Successful
11	Banner Management	Add banner	Link, status, type	Banner is saved	As expected	Successful
12	Banner Management	Activate banner	Active status	Banner is displayed on the website	As expected	Successful
13	Banner Management	Deactivate banner	Inactive status	Banner is not displayed on the website	As expected	Successful
14	Logout	Exit the system	Click logout	Redirected to the login page	As expected	Successful

4.3 Discussion

The implementation results indicate that the developed system, consisting of a public website module and a CMS, is able to support information publication needs in a more structured manner. The use of a three-tier architecture enables a clear separation of responsibilities between the interface layer, business process layer, and data storage layer. In practice, this separation simplifies content management because updates made through the CMS, such as adding or revising articles, can be stored in the database and automatically displayed on the public website without requiring manual changes to the web pages.

In terms of functional quality, all black-box testing scenarios on the core features produced outputs that matched the expected results. This indicates that the system has fulfilled the basic operational requirements for news publication and content archiving. However, the scope of testing in this study remains limited to the main functional aspects. Therefore, future development is recommended to include non-functional evaluations, such as performance testing involving response time and access load, web application security testing, and usability evaluation using measurable instruments. These additional assessments are necessary to demonstrate the feasibility of the system more comprehensively.

5. Conclusion

Based on the research and system design of the three-tier architecture-based news website and CMS at Pangkalan Susu Steam Power Plant, several conclusions can be drawn:

1. The developed news website and CMS are able to manage news content efficiently, including adding, editing, deleting, and publishing articles, allowing information to be delivered to visitors more quickly and accurately.
2. The implementation of three-tier architecture separates the presentation layer, application logic layer, and database layer, making the system easier to maintain, improving data security, and supporting future feature development.
3. The interface of both the public website and the CMS dashboard is designed to be responsive and intuitive, enabling visitors to browse news content easily and helping administrators manage content more efficiently.
4. The availability of search features, categories, and filters based on authors or topics helps visitors find the required information more effectively.
5. The use of UML, including use case diagrams, activity diagrams, and class diagrams, supports the systematic representation of system requirements, workflows, and data structures, thereby reducing the risk of errors during the implementation stage.

References

[1] A. D. Anggraini, "Sistem Informasi Website Pendidikan Non Formal PKBM Adam Kubu Raya," *Journal of Information System Management (JOISM)*, vol. 6, no. 2, 2025, doi: 10.24076/joism.2025v6i2.1938.

[2] M. D. Firmansyah and C. Christian, "Analisa Kepuasan Pengguna Kualitas Website Portal Berita Menggunakan Metode WebQual 4.0 dan Pendekatan Importance Performance Analysis (IPA) Studi Kasus Batampos.co.id," *JASIEK (Jurnal Aplikasi Sains, Informasi, Elektronika dan Komputer)*, vol. 5, no. 2, pp. 109–120, 2023, doi: 10.26905/jasiek.v5i2.11572.

[3] K. Setiono and S. D. Saputra, "Platform Turnamen E-Sport Kelas Amatir dengan Menggunakan Framework Laravel," *Jurnal Sistem Komputer dan Kecerdasan Buatan*, vol. 7, no. 2, 2024, doi: 10.47970/siskom-kb.v7i1.586.

[4] D. Setiowati, Q. H. Hidayah, and D. Nurmadewi, "Aplikasi Three Tier Sistem Informasi Manajemen Kepegawaian Menggunakan Model Prototype," *Bulletin of Computer Science Research*, vol. 5, no. 5, pp. 988–1001, 2025, doi: 10.47065/bulletincsr.v5i5.724.

[5] Y. D. Setiawan and O. Karnalim, "Transformasi Ekosistem Digital melalui Implementasi Super App untuk Meningkatkan Administrasi Kantor," *KONSTELASI*, vol. 4, no. 1, 2024, doi: 10.24002/konstelasi.v4i1.9179.

[6] S. Istikomah, T. N. Khusna, and V. Lazinu, "Implementasi Design Thinking Dalam Desain UI/UX Pada Konten Digital Informasi Agrowisata Berbasis Web," *KONSTELASI*, vol. 4, no. 2, 2024, doi: 10.24002/konstelasi.v4i2.10264.

[7] M. Z. A. Putra, D. Roliawati, K. Khalid, and A. Yusuf, "Rancang Bangun Website Jatim Parkir Center dengan Manajemen Konten Dinamis Menggunakan Laravel Filament," *Jurnal Teknologi dan Sistem Informasi Bisnis*, vol. 7, no. 4, pp. 498–506, 2025, doi: 10.47233/jteksis.v7i4.2264.

[8] M. D. Firmansyah and Christian, "Analisa Kepuasan Pengguna Kualitas Website Portal Berita Menggunakan Metode WebQual 4.0 dan IPA Studi Kasus Batampos.co.id," *JASIEK*, vol. 5, no. 2, 2023, doi: 10.26905/jasiek.v5i2.11572.

[9] M. R. Fernanda, A. Sunoto, and H. Hendrawan, "Analisis Kualitas Website Sekato Jambi Menggunakan Metode Webqual 4.0," *Jurnal Manajemen Teknologi dan Sistem Informasi (JMS)*, vol. 4, no. 2, pp. 775–784, 2024, doi: 10.33998/jms.2024.4.2.1868.

[10] A. S. Hidayatullah, T. Hariono, and A. Susanti, "Rancang Bangun LCMS Berbasis Website Pada Prodi Informatika Universitas KH. A. Wahab Hasbullah," *Exact Papers in Compilation (EPiC)*, vol. 5, no. 4, pp. 1–12, 2023, doi: 10.32764/epic.v5i4.986.

[11] F. P. E. Putra, R. W. Efendi, A. B. Tamam, and W. A. Pramadi, "Tren dan Praktik Terbaik dalam Pengembangan Web Berbasis API: Kajian Literatur terhadap Framework Laravel dan React," *Infomatek*, vol. 27, no. 1, pp. 165–178, 2025, doi: 10.23969/infomatek.v27i1.25122.

[12] R. L. Budiarti and M. Juleha, "Sistem Informasi Pengelolahan Data Operasional Kegiatan Media Berita pada Lembaga Radio Republik Indonesia (RRI) Jambi Berbasisi Web: MySql, Laravel, Filament, Tailwind CSS, Visual Studio Code, Radio Republik Indonesia (RRI) Jambi," *FORTECH (Journal of Information Technology)*, vol. 9, no. 1, pp. 9–13, 2025, doi: 10.53564/fortech.v9i1.1516.

[13] M. Alda, M. Juarsyah, A. Nugraha, and L. R. Alfachry, "Aplikasi Absensi Mahasiswa Kerja Praktik Menggunakan QR Code Berbasis Android," *Jurnal Manajemen Informatika (JAMIKA)*, vol. 14, no. 1, pp. 27–41, 2024, doi: 10.34010/jamika.v14i1.11775.

[14] C. E. E. S. Putri and A. Susanto, "Feasibility Analysis of Bengkel Koding Website Using Black Box Testing and Boundary Value Analysis," *Sinkron: Jurnal dan Penelitian Teknik Informatika*, vol. 8, no. 2, pp. 764–776, 2024, doi: 10.33395/sinkron.v8i2.13589.

[15] R. Sutjiadi, T. Rahmawati, and I. Thomas, "Perancangan dan Pembuatan Website Jasa Titip Barang dengan Menggunakan Metode Prototyping," *KONSTELASI*, vol. 2, no. 1, 2022, doi: 10.24002/konstelasi.v2i1.5540.

[16] M. Sucianto, C. I. Gosal, and E. A. Lisangan, "Perancangan Prototipe Sistem Kelola Gudang Menggunakan RFID Berbasis Android," *KONSTELASI*, vol. 2, no. 2, 2022, doi: 10.24002/konstelasi.v2i2.5611.

[17] L. D. I. Febriansyah, D. Ratnasari, and N. Agitha, "Sistem Informasi Perpustakaan Berbasis Web di Lombok Timur dengan Metode RAD," *JTIKA*, 2025, doi: 10.29303/jtika.v7i1.438.

[18] A. A. Putra, Rudiansyah, S. Romadon, and L. Iryani, "Pengembangan Prototype Sistem Informasi Akademik Menggunakan Model Logical Record Structure," *JSAI*, vol. 7, no. 2, 2024, doi: 10.36085/jsai.v7i2.7263.

[19] C. D. Atmakusuma, G. E. A. Lianury, D. Yauri, and E. A. Lisangan, "Pengembangan Prototipe Aplikasi Trackampus sebagai Presensi Mahasiswa Menggunakan QR Code dan LBS," *KONSTELASI*, vol. 2, no. 2, 2022, doi: 10.24002/konstelasi.v2i2.5599.

[20] Muhtar and H. Noprisson, "Aplikasi NotaryReq Untuk Manajemen Data Layanan Notaris Menggunakan Metodologi Prototyping," *JSAI*, vol. 8, no. 2, 2025, doi: 10.36085/jsai.v8i2.8634.

[21] I. Permatasari, F. Adhania, S. A. Putri, and S. R. C. Nursari, "Pengujian Black Box Menggunakan Metode Analisis Nilai Batas pada Aplikasi DANA," *KONSTELASI*, vol. 3, no. 2, 2023, doi: 10.24002/konstelasi.v3i2.8289.

[22] R. J. Wijayanti and S. D. Asri, "Evaluasi Sistem Informasi Distribusi Es Kristal Berbasis Web Menggunakan SUS dan UAT," *JSAI*, vol. 9, no. 1, 2026, doi: 10.36085/jsai.v9i1.9748.