*Research Article*

# Implementing Hierarchical Role-Based Access Control for Document Administration in Student Organizations

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**Abstract:** Student organizations in higher education institutions play a pivotal role in fostering leadership and collaboration. Despite their importance, many still utilize manual document administration processes, resulting in inefficiencies, delays, and a lack of transparency. This research introduces the design and implementation of a web-based Document Management System integrated with Hierarchical Role-Based Access Control (HRBAC) for student organizations at Universitas Tarumanagara. The system adopts a structured and secure framework tailored to the organization's approval hierarchy, encompassing roles such as UKM/HIMA, BEM, DPM, Faculty Advisors, Deans, and the Student Affairs Office. Each role is assigned specific access privileges to ensure secure and efficient document submission and approval workflows, aligned with organizational needs. The system was developed using the Laravel framework, PHP, HTML, SCSS, JavaScript, and MySQL, following the Waterfall methodology. Usability was evaluated using the System Usability Scale (SUS), achieving a score of 78.33, categorizing it as "Good" in terms of user experience and navigability. The findings indicate significant improvements in process automation, role-based access control, and document traceability. This research offers a comprehensive model for digital transformation in student organization administration, emphasizing the effectiveness of hierarchical access control in optimizing administrative workflows within academic institutions.

**Keywords:** web-based application, document administration, student organizations, HRBAC, System Usability Scale

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## 1. Introduction

The Student Affairs Office at Universitas Tarumanagara plays a crucial role in fostering students' potential and competencies by facilitating the initiatives of Student Organizations (Ormawa). These organizations, including the Student Executive Board (BEM), Student Representative Council (DPM), Faculty Student Activity Units (UKM), and Faculty Student Associations (HIMA), serve as platforms for leadership development, collaboration, and community engagement. They organize activities such as seminars, workshops, competitions, and cultural events [1]. These initiatives require an intricate administrative process, including the submission of Activity Proposals, Activity Permissions (SIK), and Accountability Reports (LPJ), which follow a hierarchical approval structure—from student organizations to faculty representatives, and finally to the Student Affairs Office.

Currently, the administrative process relies heavily on manual workflows, including physical document submissions and in-person coordination with faculty and university staff. This manual system has significant drawbacks, such as inefficiency, delays, errors, and potential document loss [2]. Consequently, these challenges hinder the timely execution of student organization programs and complicate coordination between stakeholders. Furthermore, the absence of an integrated platform makes it difficult for student organizations to monitor approval statuses or communicate effectively across multiple levels of authority.

To address these challenges, this study proposes the design and implementation of a web-based Document Management System (DMS) equipped with Hierarchical Role-Based Access Control (HRBAC). The system integrates document submission, approval, and tracking processes into a single platform, accessible to stakeholders based on their roles within the organizational hierarchy. This approach aims to streamline administrative workflows, enhance process efficiency, and reduce dependency on paper, thereby minimizing the risks of errors and document loss [3].

The development process prioritizes novelty by incorporating a user-centered design and addressing the specific needs of key stakeholders—Student Organizations, Faculty staff, and the Student Affairs Office. The system is designed as a Content Management System (CMS) that offers features such as submission management, approval tracking, and activity monitoring. These capabilities ensure an optimized and seamless workflow tailored to the hierarchical access levels of stakeholders. Moreover, the study contributes to advancing the digital transformation of student organization administration by addressing the inefficiencies of traditional systems through a technically sound and scalable solution.

The research conducted in the development of this web-based Document Management System (DMS) for student organizations builds upon existing literature and prior studies. These references aim to identify contributions, highlight existing gaps, and establish a foundation for creating a novel, technically robust solution.

In a study on the University of Tetova’s document management transformation, challenges in handling growing documentation needs using manual methods were addressed by implementing a comprehensive automated Document Management System (DMS). This system improved efficiency, security, and integration across platforms, such as linking with the university’s Learning Management System (LMS), which streamlined document access and processing. The integration of this DMS marked a significant improvement in managing academic and administrative tasks, showcasing technology’s role in advancing institutional workflows and operational efficiency within academic environments [4].

Justina et al. conducted research in designing the SECEDOMAS system to address inefficiencies and security issues in manual document management. The system implementation uses technologies such as HTML, CSS, JavaScript, Laravel, and MySQL. SECEDOMAS incorporates encryption through the AES algorithm to protect document confidentiality and control access. Through the process of document entry, management, and retrieval, SECEDOMAS improves data organization, reduces time consumption, and secures retrieval and sharing. It aligns with the principles of hierarchical role-based access control by ensuring document security and efficient administration, which fits the context of student organizations that require secure tiered access [5].

Falo and Encarnacion conducted a study related to the implementation of an online document management system for document processing at Saint Michael's College of Caraga (SMCC). This system aims to handle problems that often occur during manual document processing. This study found inefficiencies such as error-prone workflows and communication delays using qualitative and quantitative methods. The system was built to improve transparency and workflow by emphasizing features such as user training, backup, and user authentication. The system utilizes a role-based access system that aims to make it easier to handle easier and more secure access to documents for educational institutions [6].

Research by Sabat et al. discusses the risk assessment of automated document management systems that use a hierarchical structure. This research emphasizes the discussion of the role of security management and strong authorization for effective operations. This research presents an infrastructure model for an ADMS, focusing on security policies and risk management to secure document flows for different roles, ranging from designers to end users. This risk-based approach makes it possible to select appropriate security tools and customize protection levels based on risk assessment. The findings have been applied in structured environments such as airports, providing insight into securing document workflows in multi-level management systems [7].

The study on AI-powered Intelligent Document Management Systems (IDMS) highlights the automation of tax and administrative document processing. It focuses on integrating AI technologies such as ontology creation, data extraction, and reasoning engines to streamline document management. A case study on tax returns demonstrated the system's ability to accelerate document workflows and improve operational efficiency. The system is valuable for organizations handling large volumes of administrative documents, enabling them to allocate more resources to value-added services [8].

Susanto et al. presented an insightful exploration into the development of an information system aimed at streamlining the management of regional student organizations. This research addresses the critical challenges faced by student organizations in *the Kendal Regency* due to the lack of digitization in essential processes such as proposal approvals, work program submissions, and accountability reporting. As student organizations play a crucial role in fostering peer relationships and promoting student development, the paper emphasizes the importance of digital solutions to enhance participation and organizational efficiency. The study is situated within the design phase of an information system, focusing on both database design and interface design. It proposes the use of Node.js technology and Next.js frameworks to build a robust and scalable solution for managing student organizations. By incorporating these modern technologies, the research ensures the system can handle the demands of dynamic student organization management while providing a smooth user experience [9].

## 2. Literature Review

### *2.1 Document Management System*

A Document Management System (DMS) enables organizations to efficiently manage, store, and retrieve documents, enhancing overall productivity and operational effectiveness [10] [11]. According to Mat Yatin et al., DMS significantly reduces reliance on physical documents, minimizes the risk of errors or lost data, and improves tracking, security, and accessibility through digital solutions [12]. These systems streamline workflows by automating document-related tasks, ensuring secure access control, and reducing human errors, thereby fostering efficiency across organizational processes [13].

Moreover, digital DMS implementations contribute to organizational adaptability and productivity by facilitating workflow automation and integrating with other enterprise systems [14]. According to a recent study, key characteristics of a DMS include [3]:

2.1.1 *Reliable Digitization Mechanisms*: These allow seamless transitions from physical to digital workflows, fostering collaboration through centralized repositories with version control.

2.1.2 *Advanced Search and Access Control:* Robust search functionalities enhance document retrieval efficiency, while detailed access controls ensure data confidentiality and compliance with regulatory standards.

2.1.3 *Workflow Automation*: Automating document-oriented processes optimizes work efficiency by minimizing manual intervention and reducing errors, creating interconnected workflows through integration with other systems.

### *2.2 Hierarchical Role-Based Access Control (HRBAC)*

Hierarchical Role-Based Access Control (HRBAC) builds on Core Role-Based Access Control (RBAC) by incorporating role hierarchies that define inheritance relationships between roles [15]. This structure simplifies the management of complex access control policies [16].

In Hierarchical Role-Based Access Control (HRBAC):

2.2.1 *Role Hierarchy:* Higher-level roles inherit permissions from lower-level roles. For example, a "senior role" inherits permissions from "junior roles." If Role A inherits permissions from Role B, and Role B inherits from Role C, Role A automatically gains permissions from Role C.

2.2.2 *Dynamic Adaptation:* Organizations can define and modify role hierarchies over time without disrupting existing policies, ensuring flexibility and scalability. HRBAC enhances permission management by aligning access control policies with organizational structures and workflows, reducing redundancy, and improving administrative efficiency. This model is particularly well-suited for institutions requiring structured workflows and secure, tiered access to resources.

### *2.3 Student Organizations*

Student organizations serve as platforms for student development, aimed at achieving a common objective among their members. The primary goals of student organizations are to broaden perspectives, enhance interpersonal skills, and cultivate interests, talents, and personal potential beyond academic confines [17]. These organizations facilitate a variety of activities that play a crucial role in instilling character values among students through their active participation in event committees [18]. At Universitas Tarumanagara, several student bodies operate, including the following:

2.3.1 *Student Executive Board (BEM):* The Student Executive Board (BEM) functions as the executive body responsible for implementing policies and programs established by the university or faculty. It oversees event organization, budget management, and execution of various initiatives supported by its departments [19] [20].

2.3.2 *Student Representative Council (DPM):* The Student Representative Council (DPM) acts as a legislative body that gathers and analyzes student aspirations. The DPM is also responsible for convening consensus-based discussions to make decisions related to the student body, faculty, or university matters. Furthermore, the DPM has the authority to formulate regulations, oversee and control, and evaluate the performance of student organizations [19] [20].

2.3.3 *Student Association (HIMA):* The Student Association (HIMA) is an intra-campus organization limited to specific departments or study programs and operates under the aegis of the Student Executive Board (BEM). HIMA's primary focus is on the study and development of academic disciplines, organizing activities such as webinars or workshops that align with the specific fields of study [19].

2.3.4 *Student Activity Unit (UKM):* The Student Activity Unit (UKM) serves as an organization dedicated to developing students' interests and talents through extracurricular activities that align with the unit's focus areas. UKM emphasizes the planning, implementation, and development of extracurricular activities for students [19].

## 3. Method

### *3.1 Waterfall Method*

The Waterfall method is one of the earliest and simplest linear process models used in software development. It emphasizes the completion of each phase before starting the next and ensures that there are no overlapping phases. In this method, the development process follows a linear flow, where the completion of one phase will be the start of the next phase. In the design of student organization administration management applications, the use of this Waterfall method helps ensure that each stage of development, from needs analysis to implementation, is completed thoroughly so that no phase is missed, so this will minimize the risk of errors or omissions during development [21]. Figure 1 shows the phases of the Waterfall method.

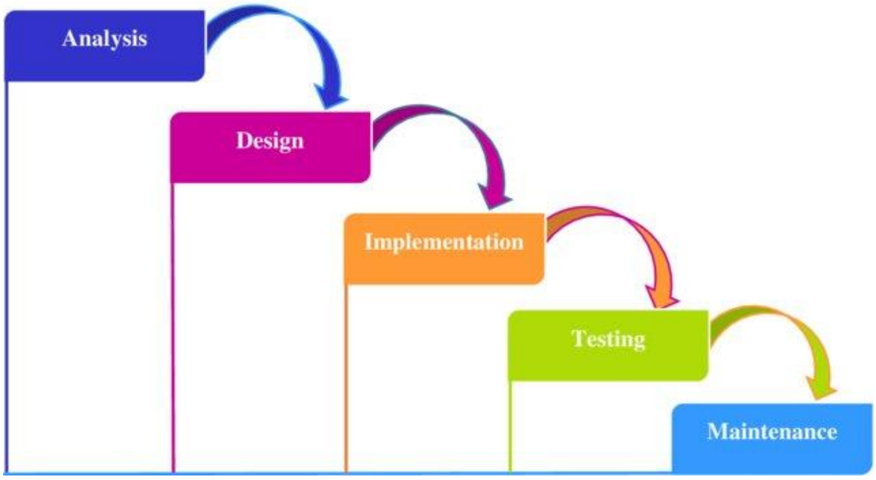


**Figure 1.** Waterfall Method

### *3.2 Analysis Phase*

The analysis phase is crucial for outlining the functional and non-functional requirements of the software system. This phase aims to identify the specific features and requirements necessary for the development of the system, ensuring that the software will meet the needs of its users and stakeholders.

In the context of this research, a key aspect of the analysis phase is determining the roles of the users involved in the document administration process. The system will implement a hierarchical role-based access control (RBAC) mechanism as shown in Table 1, where each user role has distinct responsibilities and access levels.

3.2.1 *Student Activity Unit and Student Association*: These roles are restricted to submitting documents. They cannot approve or make changes to documents. Their access is limited to creating proposals and managing their submissions.

3.2.2 *Student Executive Board and Student Representative Council*: These roles can both submit documents (in the case of the Student Executive Board for Student Activity Unit and Student Association) and approve documents. They act as intermediaries in the approval process between the lower-level roles (Student Activity Unit and Student Association) and higher-level administrative roles.

3.2.3 *Faculty Advisor, Dean, and Student Affairs Office*: These roles are primarily focused on the approval of documents. Faculty members (Faculty Advisors and Deans) approve documents from student organizations, while the Student Affairs Office, as the highest authority, finalizes the approval of documents that have been processed through the various levels.

**Table 1.** Roles and Menus in HRBAC

| **Menu** | **Roles** | | | | | | |
|---|---|---|---|---|---|---|---|
| | ***UKM*** | ***HIMA*** | ***BEM*** | ***DPM*** | ***Advisor*** | ***Dean*** | ***Student Affair*** |
| Document Submission | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| Document Tracking | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Document History | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Document Approval | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Regulation Management | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |
| User Management | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ |
| Change Password | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

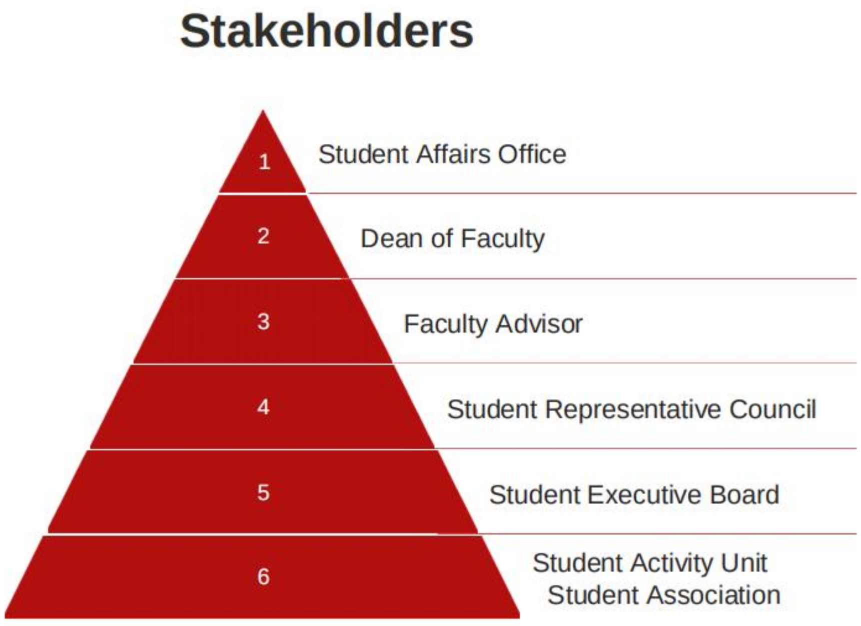


**Figure 2.** Hierarchical Structure

The hierarchical structure for document approval follows a clear, top-down flow as shown in Figure 2:

1. Student Activity Unit and Student Association submit the document for approval.
2. Student Executive Board reviews and approves the document, if applicable.
3. Student Representative Council is responsible for reviewing and approving documents from the Student Executive Board.
4. The Faculty Advisor approves documents from the Student Representative Council.
5. The Dean of Faculty is the next approver in the process, overseeing the documents approved by the Faculty Advisor.
6. Finally, the Student Affairs Office handles the final approval once all preceding roles have completed their part.

This hierarchical approach ensures that documents follow a structured and transparent approval process, where each role has its defined responsibilities. Additionally, this system guarantees that only authorized users at each level can approve or submit documents, maintaining integrity and order in the document management system.

### *3.3 Design Phase*

This phase involves architectural design such as Unified Modeling Language (UML), interface design, and database design design, which aims to create a blueprint that meets all the specified requirements.

3.3.1 *Unified Modeling Language:* Unified Modeling Language (UML) is a standardized visual language used to specify, visualize, design, and document software systems [22]. It plays a pivotal role in providing a comprehensive view of the system being developed, allowing both developers and stakeholders to clearly understand the design and structure of the system. UML facilitates communication between different project teams by offering a set of diagrams that represent various aspects of the system, such as workflow, static structure, component interactions, and behavior under specific conditions [23]. In the context of this research, which focuses on Implementing Hierarchical Role-Based Access Control (RBAC) for Document Administration in Student Organizations, UML provides a structured approach to designing and communicating the components of the RBAC system. This is crucial for understanding how roles and permissions are defined and managed within the system, as well as how access control processes interact with document submission and approval workflows.

The provided Use Case Diagram in Figure 3 illustrates the various interactions and responsibilities of different user roles within a hierarchical role-based access control (RBAC) system for document administration in student organizations. This diagram helps to visualize the functional requirements and the relationships between the users and the system's functionalities.

The UML use case diagram illustrates the interactions between various actors and the functionalities of the system for document administration within student organizations. The actors in the system include the Student Activity Unit, Student Association, Student Executive Board, Student Representative Council, Faculty Dean, Student Advisor, and Student Affairs Office. Each of these actors performs specific actions within the system.

For instance, the Student Affairs Office has the authority to manage regulations (add, edit, delete) and assign activity permissions, as well as manage user accounts (add, edit, delete) and approve documents submitted by lower-level users. The Faculty Dean & Student Advisor can manage user accounts (add, edit, delete) and approve documents submitted by lower-level users. The Student Activity Unit and Student Association are primarily responsible for submitting documents, while the Student Executive Board and Student Representative Council have the role of submitting and approving submitted documents and receiving reminders about upcoming submissions.

This use case diagram emphasizes a clear distribution of responsibilities, where higher-level roles, such as the Student Affairs Office, have extensive permissions to manage users and documents, whereas lower-level roles like the Student Activity Unit and Student Association primarily focus on document submission. This hierarchical structure ensures that the system is both secure and efficient, as it limits access based on defined roles and responsibilities.

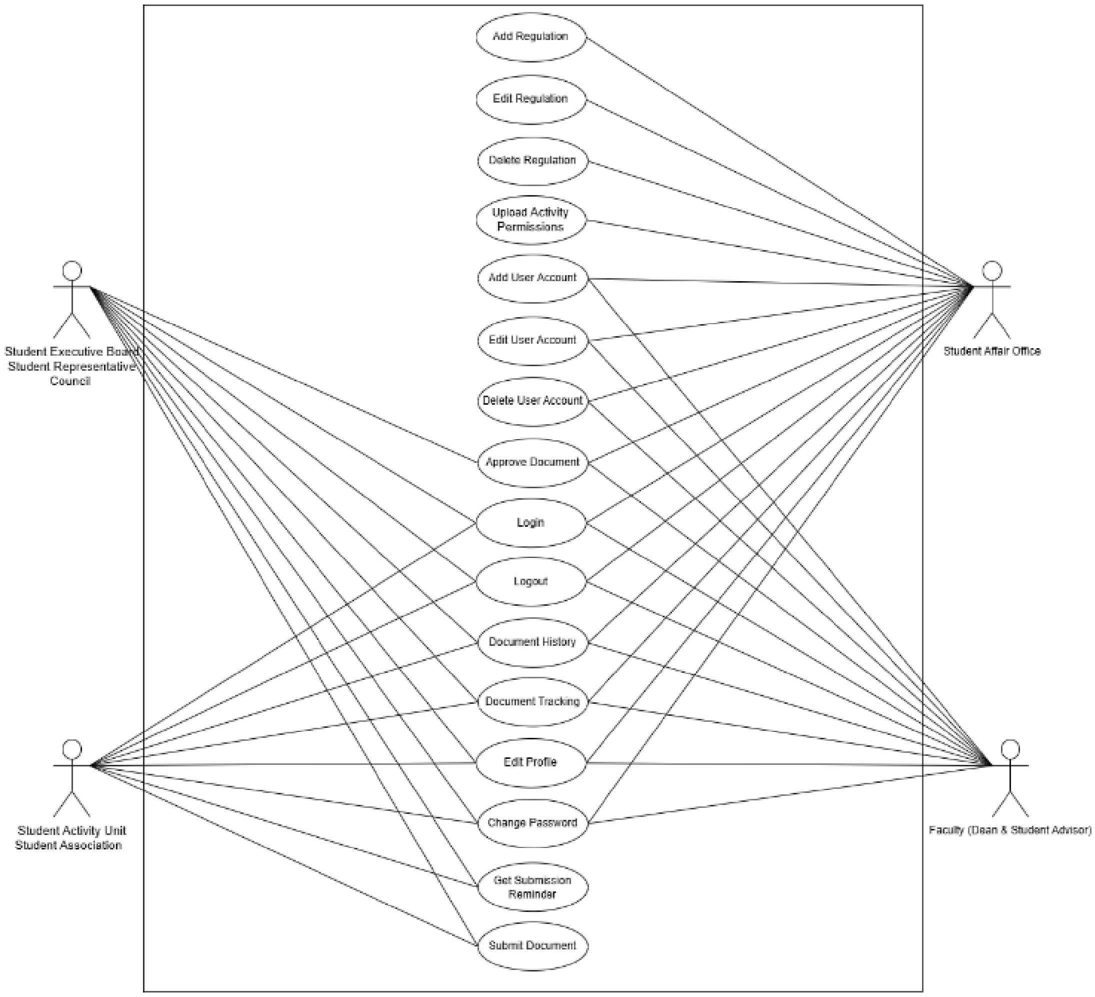


**Figure 3.** Use Case Diagram

3.3.2 *Database Structure:* The database structure shown in Figure 4 is a detailed schema designed to implement hierarchical role-based access control (RBAC) for document administration within student organizations applying Connolly's logical database design methodology provides a structured framework for creating a robust database system. Connolly's approach focuses on translating business requirements into a database schema that supports the system's operations and facilitates easy data retrieval, modification, and maintenance [24].

- *Organizations Table*: This table (organizations) holds information about different student organizations. Key fields include organization_id (primary key) and org_name.
- *User Types and Users Tables: The* user_types table defines different categories of users based on their roles or permissions. The users table contains user details for individuals within the organizations, linked to their roles through the user_types table. Key fields in users include user_id (primary key), username, and links to organization_id and user_type_id.
- *Role Hierarchies:* The system uses the supervisor's table to establish a hierarchy. This allows specifying which user (or role) supervises another, supporting the hierarchical nature of access control. It's possible to have a complex role hierarchy by recursively associating supervisors with users.
- *Documents Management:* This is broken down into several tables, such as document_types, document_submission, document_approval, and document_status, each designed to handle specific aspects of document management. document_types defines different types of documents handled by the system. document_submission captures when and by whom documents are submitted. document_approval tracks the approval process, and document_status records the current status (e.g., pending, approved).
- *Access Control Elements:* The role and document access control likely integrate through key associations in these tables, using the role hierarchy to control who can access and approve each document type. Negative announcements in the negative_announcements table might refer to actions or decisions communicated to restrict or change access.
- *Flexibility in Extensions:* The structure supports flexibility and scalability. New roles or document types can be added without significant changes to the schema, reflecting a robust design suitable for evolving organizational needs.

This schema effectively implements hierarchical RBAC by structuring data to enforce permissions at various levels (organizational, role, user), combined with comprehensive document management capabilities. This helps in securely managing documentation processes within student organizations, ensuring that access is controlled and monitored based on established hierarchies.

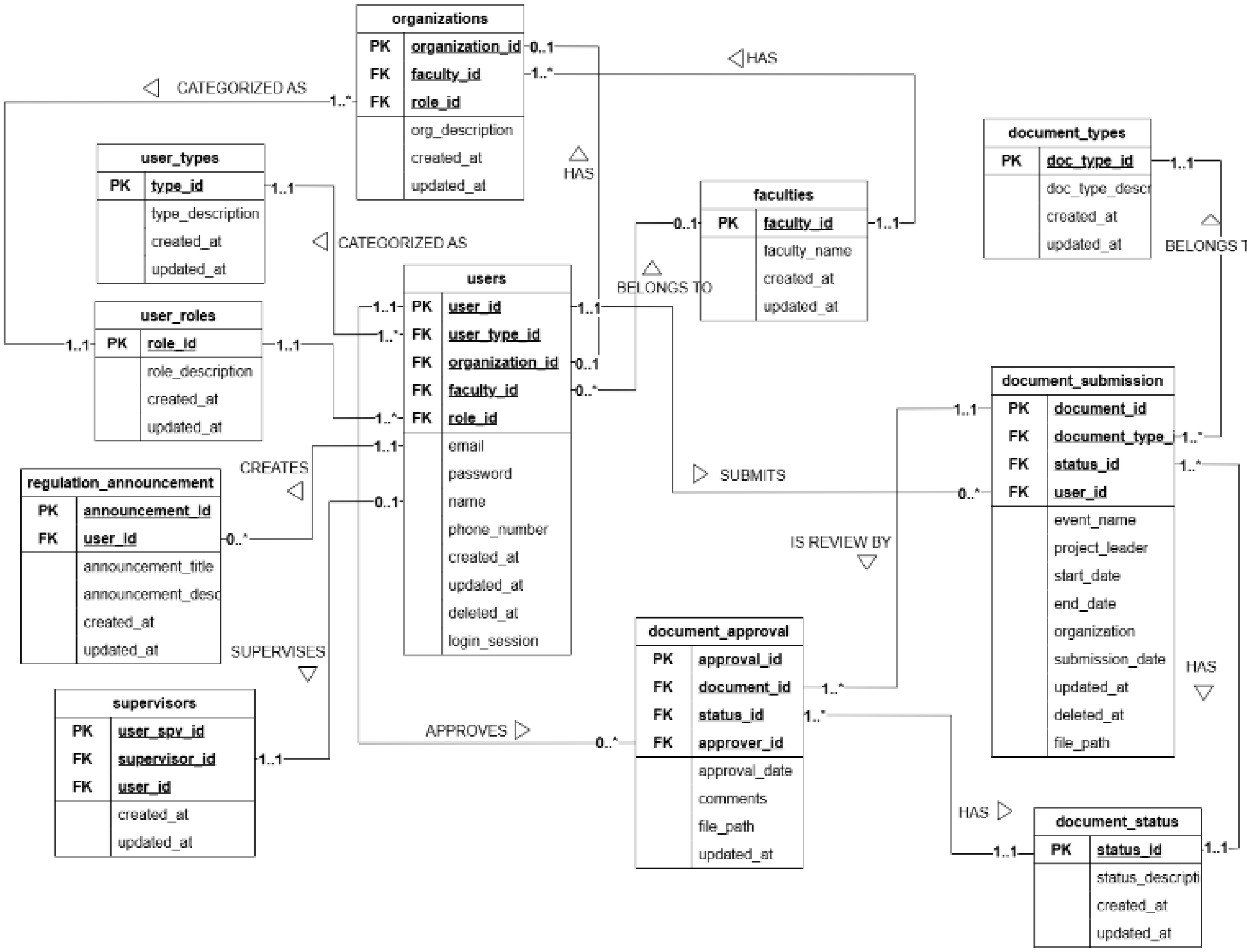


**Figure 4.** Database Structure

### 3.4 *Implementation Phase*

In the Implementation Phase, the system is developed by translating the design specifications into executable code, setting up the database, and implementing access control mechanisms.

Implementation and detailed configuration of Hierarchical Role-Based Access Control (HRBAC) in a Laravel-based document management system designed for student organizations. The HRBAC model is applied to restrict or allow access at various levels, ensuring that each user role such as Submitter, Approver, and Administrator can only access relevant functions. The system follows a hierarchical approval process, starting from student organizations UKM/HIMA, through BEM, DPM, Student Advisor, Dean of Faculty, to the Student Affairs Office. Therefore, when a document is submitted by an applicant (UKM/HIMA/BEM/DPM), it follows a specific approval hierarchy.

#### *3.4.1 Controller-Level Access Control: Middleware in Laravel enforces role-based access, exemplified by:*

- The SubmissionController, which restricts access to roles authorized to submit documents (e.g., student organization members). Submitted documents are then routed to the next hierarchical role for review.
- The ApprovalController, grants access only to designated approvers in the hierarchy (e.g., Student Advisors, Faculty Dean, and the Central Student Affairs Unit). This setup enforces strict control over document approvals and aligns with the organization’s document-handling protocol.

3.4.2 *Role-Based View Rendering:* Conditional role-based navigation is integrated within Blade templates to enable dynamic content rendering based on user roles. For example:

```
@foreach ($menuData[0]->menu as $menu)
    @if (isset($menu->roles) && in_array($userRole, $menu->roles))
        //code...
    @endif
@endforeach
```

Navigation Configuration (in VerticalMenu.json)

```
{
    "name": "Document Approval",
    "icon": "menu-icon tf-icons bx bx-message-square-check",
    "slug": "document-approval.index",
    "url": "/document-approval",
    "roles": [
        "RL002",
        "RL004",
        "RL005",
        "RL006",
        "RL007"
    ]
}
```

- @foreach Loop: This loops through each menu item ($menuData[0]->menu) that needs to be displayed.
- Role Check (@if statement): The @if condition checks if the current menu item has specific roles assigned ($menu->roles). It then verifies if the logged-in user’s role ($userRole) matches any of the assigned roles in the menu item.
- Rendering: If the user's role is found in the roles array, the corresponding menu item will be rendered. This ensures that users only see options relevant to their roles.
- This approach prevents unauthorized access to specific pages, displaying only relevant options based on hierarchical role. This role-based rendering enhances the security and usability of the system.

### *3.5 Testing Phase*

The solution undergoes verification and validation to ensure it meets the initial specifications. Testing identifies and addresses bugs to ensure functionality is fit for purpose.

### *3.6 Maintenance Phase*

After deployment, the software is refined to handle user feedback, correct errors, and meet new requirements. This phase ensures the adaptability and reliability of the software in the long run.

## 4. Result and Discussion

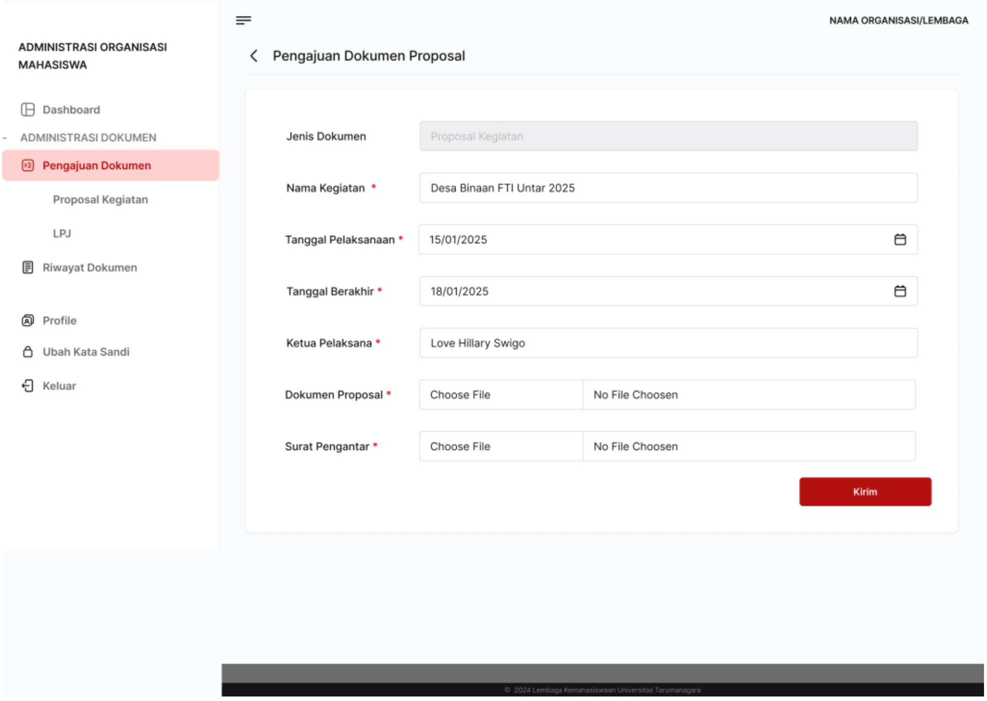
The user interface depicted in Figure 5 illustrates a dedicated submission page for proposal documents, specifically designed for student organizations. This page is a critical component of the document management process, ensuring that submissions are properly routed through the correct approval hierarchy. Access to this page is controlled by a comprehensive hierarchical RBAC system that restricts access based on the user's role within the organization.

When a user logs into the system, their role is verified, and access is granted to the submission page based on the defined permissions. Roles such as BEM (Student Executive Board), DPM (Student Representative Council), HIMA (Student Association), and UKM (Student Activity Units) are authorized to use this feature. Users attempting to access the page without the necessary role are redirected to a restricted page, ensuring that sensitive documents are handled only by authorized personnel. This method ensures a high level of data integrity and security in document management, as only those with the appropriate role can interact with the system.

The form on the submission page collects essential information, such as document type, event name, event dates, and location, alongside any required attachments (e.g., proposal documents and cover letters). Built-in validation ensures that all necessary fields are completed correctly and that uploaded files comply with specified size and format requirements. This guarantees both the completeness and accuracy of the submissions.

Once the user submits the form by clicking the "Kirim" (Submit) button, the system triggers a validation process. If the submission meets all conditions, the document is forwarded to the next level of the hierarchy for review and approval. The hierarchical workflow follows a clear progression: from the Student Activity Units or Student Association to the Student Executive Board, Student Representative Council, Faculty Advisor, Dean of Faculty, and finally Student Affairs Office. This design ensures that the submission progresses smoothly, maintaining transparency and accountability at each stage.

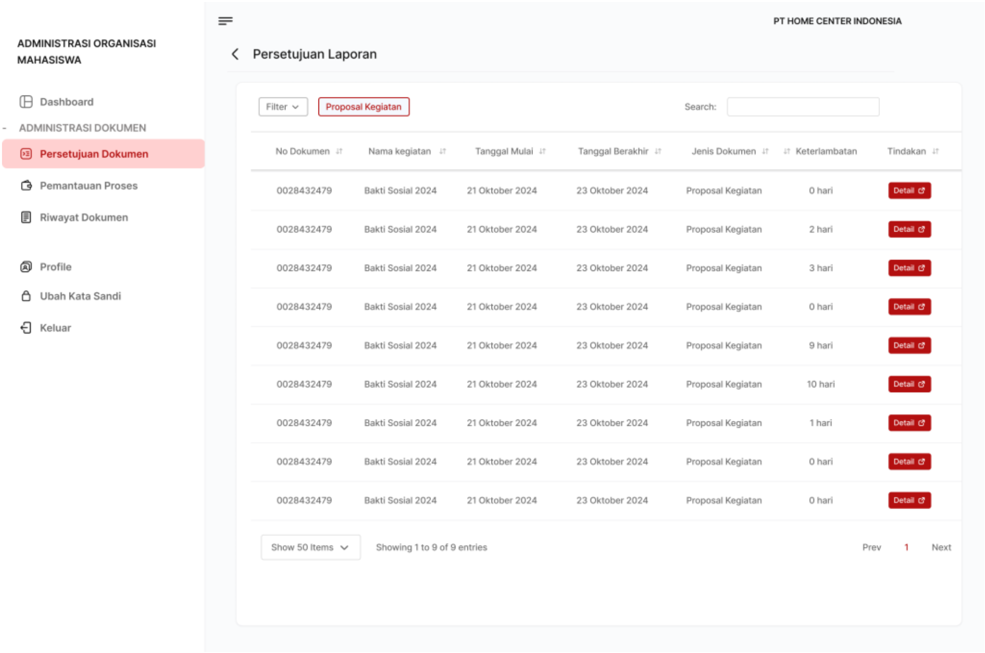
The interface shown in Figure 6 represents the "Report Approval" page, where documents are reviewed and approved within a structured hierarchy. This page is integral to the document management process, where only documents submitted or approved by roles directly subordinate to the logged-in user are visible for further action.



Pengajuan Dokumen Proposal

| | | |
|---|---|---|
| Jenis Dokumen | Proposal Kegiatan | |
| Nama Kegiatan * | Desa Binaan FTI Untar 2025 | |
| Tanggal Pelaksanaan * | 15/01/2025 | |
| Tanggal Berakhir * | 18/01/2025 | |
| Ketua Pelaksana * | Love Hillary Swigo | |
| Dokumen Proposal * | Choose File | No File Choosen |
| Surat Pengantar * | Choose File | No File Choosen |

**Figure 5.** Document Submission Page



| No Dokumen | Nama kegiatan | Tanggal Mulai | Tanggal Berakhir | Jenis Dokumen | Keterlambatan | Tindakan |
|---|---|---|---|---|---|---|
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 0 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 2 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 3 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 0 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 9 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 10 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 1 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 0 hari | Detail |
| 0028432479 | Bakti Sosial 2024 | 21 Oktober 2024 | 23 Oktober 2024 | Proposal Kegiatan | 0 hari | Detail |

Showing 1 to 9 of 9 entries

**Figure 6.** Document Approval Page

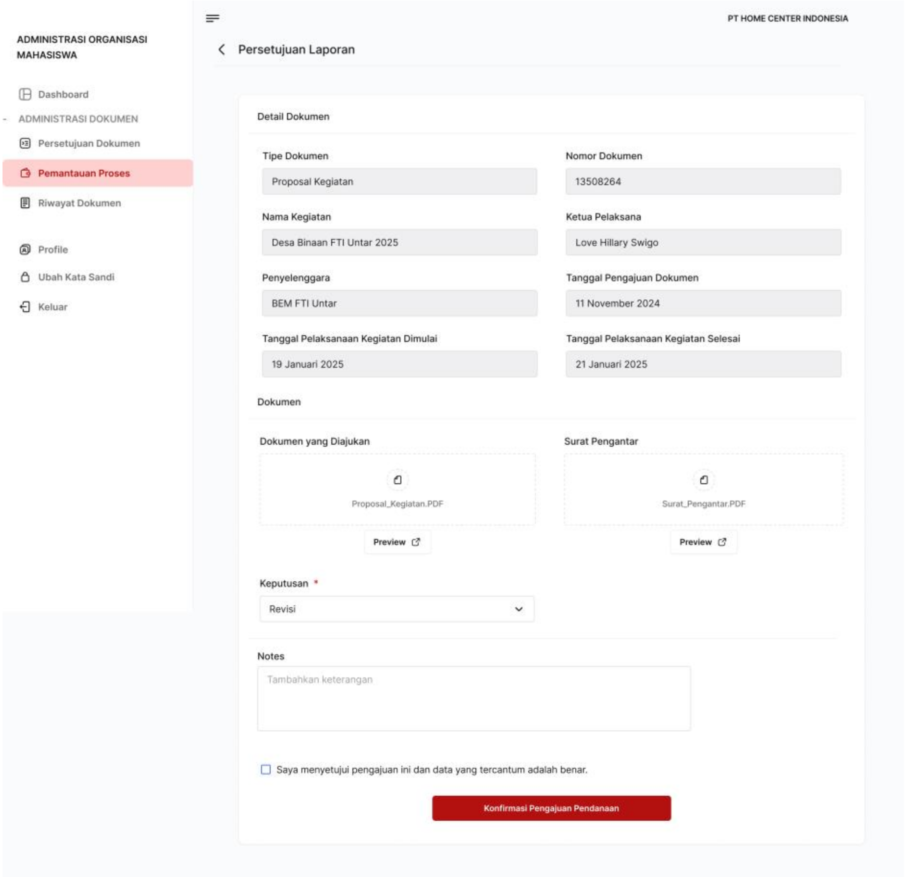
When users log into the system, their role is authenticated, and relevant document entries appear, reflecting the documents that require their attention or approval. The hierarchical structure ensures that each user is only responsible for overseeing documents related to their direct subordinates. This minimizes the risk of unnecessary data exposure and ensures a clear line of oversight. This feature not only strengthens the security and confidentiality of the process but also enhances efficiency by focusing users' attention on their relevant responsibilities.

By controlling the view and action capabilities according to the user's role and direct subordinates, the system prevents bottlenecks in the approval process and promotes accountability. This hierarchical approach supports the efficient progression of documents through the approval process and ensures that organizational procedures are adhered to at each level.

Each document entry includes a "Detail" button, which allows the user to access more comprehensive information about the document. This capability ensures that users can make well-informed decisions regarding each document, as they can review all pertinent details and historical actions or comments related to the submission.

The user interface presented in Figure 7 is focused on document approval, specifically facilitating the "Report Approval" process within a structured workflow. This page provides users with comprehensive details regarding a submitted proposal document, including key information such as the document type, document number, event name, location, and relevant dates (both submission and event dates). This rich set of information is crucial for users to make informed decisions about the document's validity and appropriateness for approval or rejection.

When a user engages with this page, they are afforded the crucial ability to either approve or reject the document in question. If the user opts to approve the document, the system initiates a seamless process where the approved proposal is forwarded to the next hierarchical level for further review or additional approvals. This streamlined progression is vital for maintaining efficiency within the document management workflow, ensuring that all submissions undergo the necessary scrutiny according to the organization's established protocols. Alongside the approval, users have the option to upload any relevant approval documents or supporting materials, such as signed letters of endorsement. This uploaded file accompanies the approved proposal as it ascends through the hierarchy, providing the next authority level with the necessary context and validation.



Persetujuan Laporan

Detail Dokumen

Tipe Dokumen: Proposal Kegiatan

Nomor Dokumen: 13508264

Nama Kegiatan: Desa Binaan FTI Untar 2025

Ketua Pelaksana: Love Hillary Swigo

Penyelenggara: BEM FTI Untar

Tanggal Pengajuan Dokumen: 11 November 2024

Tanggal Pelaksanaan Kegiatan Dimulai: 19 Januari 2025

Tanggal Pelaksanaan Kegiatan Selesai: 21 Januari 2025

Dokumen

Dokumen yang Diajukan: Proposal_Kegiatan.PDF
Preview

Surat Pengantar: Surat_Pengantar.PDF
Preview

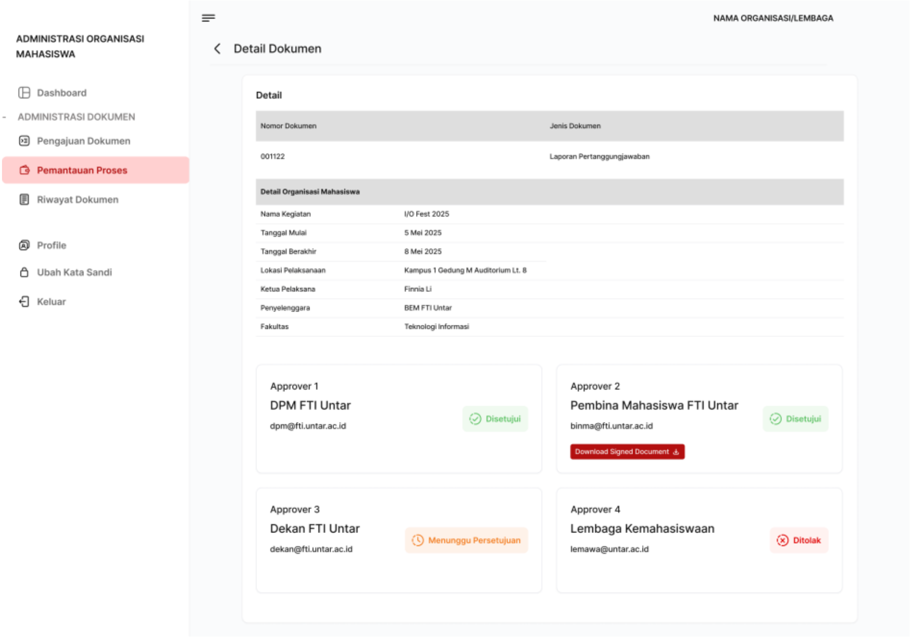
Keputusan *: Revisi

Notes: Tambahkan keterangan

☐ Saya menyetujui pengajuan ini dan data yang tercantum adalah benar.

Konfirmasi Pengajuan Pendanaan

**Figure 7.** Document Approval Detail Page



Detail Dokumen

Detail

| Nomor Dokumen | Jenis Dokumen |
|---|---|
| 001122 | Laporan Pertanggungjawaban |

| Detail Organisasi Mahasiswa | |
|---|---|
| Nama Kegiatan | I/O Fest 2025 |
| Tanggal Mulai | 5 Mei 2025 |
| Tanggal Berakhir | 8 Mei 2025 |
| Lokasi Pelaksanaan | Kampus 1 Gedung M Auditorium Lt. 8 |
| Ketua Pelaksana | Finnia Li |
| Penyelenggara | BEM FTI Untar |
| Fakultas | Teknologi Informasi |

Approver 1
DPM FTI Untar
dpm@fti.untar.ac.id
Disetujui

Approver 2
Pembina Mahasiswa FTI Untar
binma@fti.untar.ac.id
Disetujui
Download Signed Document

Approver 3
Dekan FTI Untar
dekan@fti.untar.ac.id
Menunggu Persetujuan

Approver 4
Lembaga Kemahasiswaan
lemawa@untar.ac.id
Ditolak

**Figure 8.** Document Tracking Detail Page

Conversely, if the user decides to reject the document, the system facilitates a straightforward process where the document is returned to the original submitter. This return action is coupled with feedback or comments that elucidate the reasons behind the rejection. Such transparency is essential, as it enables the submitter to understand the adjustments required for re-evaluation. The interface includes a comments field where users can provide detailed explanations or suggestions for success, ensuring constructive communication and documentation of the decision-making process.

The user interface depicted in Figure 8 is designed for document submitters to review the status and content of their submitted documents. This page offers transparency in the document management process, ensuring submitters can easily track the status of their submissions. Key details such as the document number, type, and event information are prominently displayed to help users quickly assess the status of their proposals.

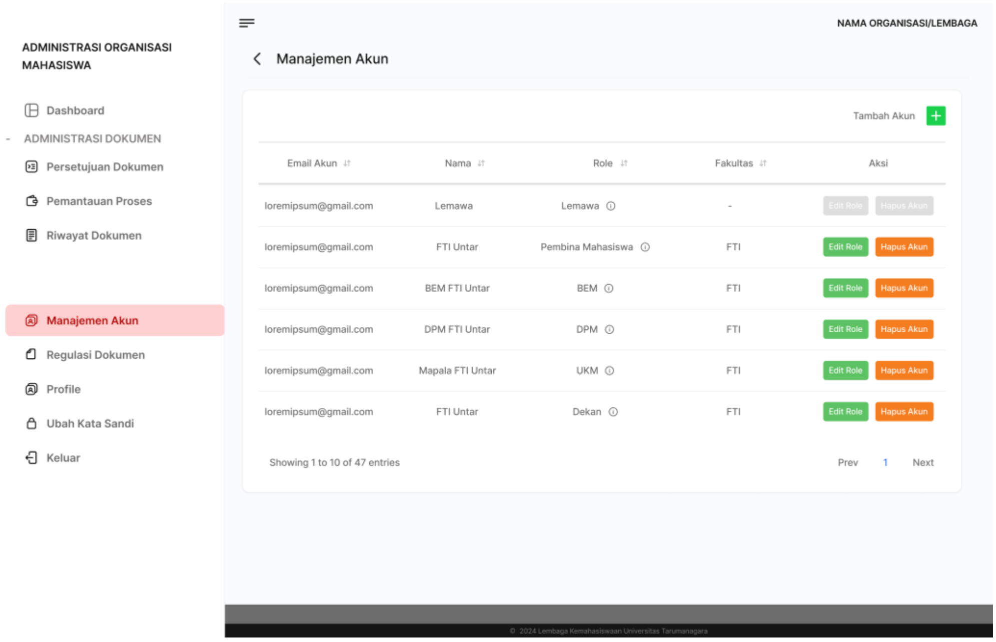
Submitters are informed about the current status of their document, whether it is pending approval or has been returned for revisions. This feature enhances the user's ability to follow up on their submission and ensures that they can take appropriate action when required.

The user interface shown in Figure 9 represents the Account Management page, an essential administrative feature designed specifically for the highest level of the organizational hierarchy within the student organization system. This page allows users with the highest authority to efficiently manage user accounts, ensuring that the right individuals have appropriate access and roles aligned with their responsibilities.

Upon entering the Account Management page, users are greeted with a structured table listing all existing user accounts. Each entry in the table includes vital information such as the user's email address, assigned role, and the faculty they belong to. This comprehensive view enables administrators to easily assess the composition of their organization and manage access rights effectively.

The page provides several key functionalities. Users with the necessary permissions can add new accounts, allowing them to expand the organizational structure by integrating additional roles and responsibilities as needed. The option to edit existing accounts is equally crucial; administrators can modify user details, ensuring that the information remains current and accurate. This includes the ability to change roles assigned to each user, thereby enabling flexibility in the hierarchical structure as organizational needs evolve.

Moreover, to maintain security and operational integrity, the interface also features a Delete function, allowing administrators to remove user accounts. This capability is particularly important for managing personnel changes or ensuring that access is timely revoked when individuals no longer hold a role within the organization. Administrators can execute these actions efficiently through the interface, with clear options marked for Edit and Delete next to each user entry.



Manajemen Akun

| Email Akun | Nama | Role | Fakultas | Aksi |
|---|---|---|---|---|
| loremipsum@gmail.com | Lemawa | Lemawa ⓘ | - | Edit Role Hapus Akun |
| loremipsum@gmail.com | FTI Untar | Pembina Mahasiswa ⓘ | FTI | Edit Role Hapus Akun |
| loremipsum@gmail.com | BEM FTI Untar | BEM ⓘ | FTI | Edit Role Hapus Akun |
| loremipsum@gmail.com | DPM FTI Untar | DPM ⓘ | FTI | Edit Role Hapus Akun |
| loremipsum@gmail.com | Mapala FTI Untar | UKM ⓘ | FTI | Edit Role Hapus Akun |
| loremipsum@gmail.com | FTI Untar | Dekan ⓘ | FTI | Edit Role Hapus Akun |

Showing 1 to 10 of 47 entries Prev 1 Next

**Figure 9.** Account Management Page

### A. *System Usability Scale (SUS)*

The System Usability Scale (SUS) provides a structured approach to assessing usability, often through a questionnaire rated on a 5-point Likert scale [25]. To compute the SUS score:

1. For odd-numbered questions, subtract 1 from each score.
2. For even-numbered questions, subtract each score from 5.
3. Sum these adjusted scores and multiply by 2.5 to convert the score to a 0-100 scale.

The final average SUS score is calculated by dividing the total score by the number of respondents, following this formula 1.

$$\bar{x} = \frac{\sum x}{n} \quad (1)$$

Where:

- $\bar{x}$ is the average score,
- $\sum x$ is the sum of all respondent scores,
- $n$ is the total number of respondents.

**Table 2.** System Usability Scale (SUS) Score

| User | System Usability Scale | | | | | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Q1* | *Q2* | *Q3* | *Q4* | *Q5* | *Q6* | *Q7* | *Q8* | *Q9* | *Q10* | |
| U1 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | 82.5 |
| U2 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 97.5 |
| U3 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 90 |
| U4 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 75 |
| U5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 4 | 90 |
| U6 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 3 | 3 | 0 | 67.5 |
| U7 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 3 | 3 | 75 |
| U8 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 92.5 |
| U9 | 4 | 1 | 3 | 0 | 3 | 3 | 4 | 4 | 1 | 0 | 57.5 |
| U10 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 65 |
| U11 | 3 | 3 | 4 | 2 | 4 | 3 | 3 | 4 | 4 | 2 | 80 |
| U12 | 4 | 2 | 4 | 2 | 4 | 3 | 4 | 0 | 4 | 0 | 67.5 |
| | | | | | | | | | | **Avarage Score** | **78.33** |

The analysis of the System Usability Scale (SUS) results in Table 2 reveals an average score of 78.33, placing the web application in the "Good" category in terms of usability. This score indicates that, overall, users felt satisfied with their experience using the application and perceived it as relatively easy to use. The average SUS score reflects a positive user experience, suggesting that users can accomplish their tasks efficiently within the application.

In the results table, each respondent rated various aspects of usability on a scale from 1 to 4, where higher scores indicate greater satisfaction and ease of use. The total scores from respondents ranged from 23 to 39. Notably, Respondent 2 achieved the highest score of 39, indicating a very high level of satisfaction with the application's usability. In contrast, the lowest score recorded was 23 from Respondent 9, who expressed concerns with certain aspects of the application.

The results suggest that while the application is generally perceived as user-friendly, there are areas for improvement. Respondents provided valuable feedback, including suggestions for more attractive color selections and the addition of tooltips for certain features to enhance understanding and usability. Such insights can guide future development to further enhance the user experience, ensuring that the application meets the needs and expectations of its users more effectively.

Overall, the SUS analysis highlights that the web application effectively meets usability standards and satisfies users, while also providing actionable recommendations for enhancing its design and functionality.

## 5. Conclusion

In conclusion, the implementation of hierarchical role-based access control (RBAC) for document administration within student organizations represents a substantial advancement in both the security and efficiency of document management. By establishing a well-defined structure of roles and permissions, the system ensures not only enhanced accountability at various organizational levels but also streamlined workflows for document submissions and approvals. This method fosters an organized and efficient environment for managing sensitive documents, helping maintain a transparent and secure process for all stakeholders.

The hierarchical structure plays a critical role in enabling clear oversight, allowing higher-level authorities to review and approve documents submitted by lower-level roles. This ensures a smooth and coherent flow of information across the different levels of authority while reducing the risk of unauthorized access to critical data. By adhering to established protocols, the system maintains the integrity and confidentiality of the documents being processed.

Furthermore, the inclusion of user feedback gathered through tools such as the System Usability Scale (SUS), has provided significant insights into the usability and effectiveness of the implemented system. The positive feedback highlights the users' satisfaction with the application's functionality and ease of use, while also offering valuable suggestions for future improvements. These insights are essential for refining the system to meet the evolving needs of its users and ensure the platform remains user-centric.

This research addresses a pressing need in student organization document administration, and while the hierarchical RBAC model contributes significantly to enhancing the workflow, there is still room for further development. The novelty of this research lies in the application of RBAC in the context of student organizations, a domain that has not been fully explored in existing literature. Future work will focus on exploring deeper technical aspects of the system, particularly the scalability of the RBAC model to accommodate larger and more complex organizational structures. Additionally, the use of automated processes and intelligent algorithms to predict and optimize document flow could further improve the efficiency of the system.

Future research will also seek to integrate machine learning techniques to enhance the adaptability of the RBAC model, allowing it to better respond to evolving organizational structures and requirements. The feedback from this study will serve as a foundation for continuous improvement, ensuring that the system not only remains secure and efficient but also flexible enough to meet the needs of dynamic student organizations. By incorporating advanced analytics and automated features, future developments could further reduce administrative burdens and promote more effective document management, positioning student organizations for long-term success.

In summary, the hierarchical RBAC system offers a robust solution to document administration in student organizations. By fostering transparency, accountability, and security, this model is a vital tool in the ongoing digital transformation of administrative processes. The continued evolution of this system, through both technical enhancements and ongoing feedback, will ensure its continued relevance and effectiveness in addressing the needs of student organizations in the future.

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**Availability of data and Materials:** All data are available from the authors.

**Conflicts of Interest**: The authors declare no conflict of interest.

**Additional Information:** No Additional Information from the authors.

## References

1. Natsir. U.D., et.al. “The Role of Organizations in Developing Students' Soft Skills at UKM SINTALARAS UNM,” Jurnal Ilmiah Pariwisata, vol. 21, no. 1, pp. 133-141, Januari 2024.
2. T. Panfilova, V. Tynchenko, O. Kukartseva, A. Kozlova and A. Glinscaya, "Modernization of electronic document management and systems analysis processes using an automated platform," E3S Web of Conferences, p. 549, July 2024.
3. I. Orlov, “Role of document management system for business processes optimization,” Problems of Theory and Methodology of Accounting, Control and Analysis, pp. 45-49, 2024.
4. F. Imeri, A. Memeti, F. Sadiki, F. Idrizi and E. Memeti, " Transforming Document Management: The Integration of an Automated System at the University of Tetova," Journal of Natural Sciences & Mathematics (JNSM), vol. 9, pp. 333-339, October 2024.
5. I. A. Justina, E. A. Oyekan and O. M. Orogbemi, "A Secured Cloud-Based Electronic Document," International Journal of Innovative Research and Development, vol. 11, no. 12, December 2022.
6. R. A. Falo and R. E. Encarnacion, "Streamlining Document Processing: Basis for an online Document Management System," International Journal of Advanced Research in Science, Communication, and Technology, vol. 4, no. 1, pp. 394-403, June 2024.
7. V. Sabat, B. Durnyak, T. Dytko, and O. Onufrei, " Risk Assessment of an Automated Document Management System in a Hierarchical Management System," Acta Avionica Journal, vol. 25, no. 2, pp. 5-14, December 2023.
8. G. D. M. Serugendo, M. A. Cappelli, G. Falquet, C. Métral, A. Wade, S. Ghadfi, A.-F. Cutting-Decelle, A. Caselli and G. Cutting, "Streamlining Tax and Administrative Document Management with AI-Powered Intelligent Document Management System," Information, vol. 15, p. 461, August 2024.
9. F. G. P. Susanto, N. I. Y. Fadlan and P. Haryani, "Design of Web-Based Management Information System for Student Organizations in Kendal Regency Using Next.js Framework," COMPILER, vol. 12, no. 1, pp. 9-20, May 2023.
10. S. M. Alade, "Design and Implementation of a Web-based Document Management System," International Journal of Information Technology and Computer Science, vol. 15, no. 2, pp. 35-53, April 2023.
11. O. O. Shoewu, L. A. Akinyemi, and D. Adamu, "Information technology management: Application, effects and challenges of electronic document management system (EDMS) in the education sector," International Journal of Multidisciplinary Research and Growth Evaluation, vol. 4, no. 3, pp. 765-770, 2023.
12. F. H. Kiplie, S. F. M. Yatin, M. Angutim and N. H. A. Hamid, "System Development for Document Management System," International Journal of Academic Research in Business and Social Sciences, vol. 8, no. 9, p. 748–757, October 2018.
13. J. Orioque, S. Pajaron and J. Cabardo, "Contextualized Online Document Management System," Journal of Innovative Technology Convergence, vol. 6, no. 1, pp. 65-74, April 2024.
14. A. Ikuomola, E. A. Oyekan and O. M. Orogbemi, "A Secured Cloud-Based Electronic Document Management System," International Journal of Innovative Research and Development, vol. 11, no. 2, pp. 38-45, December 2022.
15. E. Mpamugo and G. Ansa, "Enhancing Network Security in Mobile Applications with Role-Based Access Control," Journal of Information Systems and Informatics, vol. 6, no. 3, pp. 1872-1899, September 2024.
16. OASIS, "XACML v3.0 Core and Hierarchical Role Based Access Control (RBAC) Profile Version 1.0," 2014. [Online]. Available: https://docs.oasis-open.org/xacml/3.0/rbac/v1.0/cs02/xacml-3.0-rbac-v1.0-cs02.html. [Accessed 15 November 2024].
17. E. Basanova, "The Role of the Student Council in the Management of the Educational Organization," Socio-Humanitarian Research and Technology, vol. 13, no. 2, pp. 28-32, 2024.
18. A. D. Pertiwi, R. N. Septian, R. Ashifa and P. Prihantini, "Peran Organisasi Kemahasiswaan dalam Membangun Karakter: Urgensi Organisasi Kemahasiswaan pada Generasi Digital," Aulad : Journal on Early Childhood, vol. 4, no. 3, pp. 107-115, 11 November 2021.
19. H. T. Rozik, "mengenail lebih detail tentang UKM DAN Ormawa yang ada di kampus," OSG (Online Scholarship Competition), 26 September 2022. [Online]. Available: https://osc.medcom.id/community/mengenail-lebih-detail-tentang-ukm-dan-ormawa-yang-ada-di-kampus-4186. [Accessed 15 Agustus 2024].

20. Kelvin, Tony dan T. Sutrisno, “Sistem Informasi Organisasi Kemahasiswaan Berbasis Web Pada Universitas Tarumanagara,” Jurnal Ilmu Komputer dan Sistem Informasi, vol. 12, no. 1, 20 Januari 2024.
21. R. Kneuper, Software Processes and Life Cycle Models: An Introduction to Modelling, Using and Managing Agile, Plan-Driven and Hybrid Processes, Darmstadt: Springer International Publishing, 2018.
22. B. M. Esiefarienrhe and T. J. Moemi, "UML Design of Business Intelligence System for Small-Scale Enterprises," Journal of Information Systems and Informatic, vol. 6, no. 1, pp. 495-513, March 2024.
23. J. Rumbaugh, I. Jacobson dan G. Booch, The Unified Modeling Language Reference, Massachusetts: Addison Wesley, 2021.
24. T. M. Connoly dan C. E. Begg, Database Systems: A Practical Approach to Design, Implementation, and Management, Global Edition, Harlow: Pearson Education, 2015.
25. MeasuringU, "System Usability Scale (SUS)," MeasuringU, 2011. [Online]. Available: https://measuringu.com/sus/. [Accessed 14 November 2024].