



Article

# Design and Implementation of an Integrated Internal Collaboration and Communication Platform Using the SDLC Waterfall Method

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## SUBMISSION TRACK

Received: 12, 16, 2025

Final Revision: 01, 05, 2026

Available Online: 02, 02, 2026

## KEYWORD

Internal Collaboration System, Organizational Communication, Hybrid Work, SDLC Waterfall, Real-Time Messaging

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## A B S T R A C T

Collaboration and communication platforms play a critical role in supporting modern organizations, particularly those operating in hybrid and remote working environments. These platforms enhance workflow efficiency, improve coordination across teams, and facilitate seamless information exchange. This study aims to design and implement an integrated internal collaboration and communication system that unifies chat, discussion forums, file sharing, and internal video conferencing within a single platform. The system was developed using the Software Development Life Cycle (SDLC) with the Waterfall model, which includes requirement analysis, system design, implementation, and testing phases. Data collection was conducted through direct observation and structured interviews to identify user needs and determine system requirements. Functional testing was carried out to assess system performance, interface responsiveness, and feature reliability. The results indicate that all major functionalities work effectively, including real-time messaging, collaborative document editing, centralized file management, and virtual meeting capabilities. Overall, the proposed platform enhances coordination efficiency, reduces data fragmentation, and minimizes reliance on external third-party applications. This research provides a comprehensive and structured blueprint for developing integrated internal collaboration systems that support effective communication and centralized information management within organizational environments.

## I. INTRODUCTION

The development of information technology in recent years has driven a shift in work paradigms across business, government, and educational institutions [1]. Digital transformation has impacted not only operational processes but also communication and collaboration patterns between individuals within a company [2]. Activities previously conducted face-to-face have now shifted to hybrid and online models due to the need for efficiency, flexibility, and increasingly common remote working patterns in modern companies [3]. This makes digital collaboration technology a crucial component in supporting smooth coordination, information exchange, and more structured work completion.

Digital transformation has made communication needs no longer dependent on physical meetings [4], [5]. Activities such as meetings, discussions, document distribution, and conversations between organizational members can now be conducted online through a centralized system [6]. The collaboration and communication platform designed in this study integrates key features such as instant messaging (chat), discussion forums, file sharing, and video conferencing [7], [8]. This integration aims to address common company issues, such as slow information delivery, undocumented coordination, scattered document storage, and ineffective inter-divisional communication [9].

The need for such systems is increasing as modern corporate work patterns shift toward hybrid working and remote collaboration [10]. Real-time communication through chat features allows users to exchange messages directly, without the constraints of distance and time [11]. Meanwhile, discussion forums serve as a structured, formal conversation documentation space, allowing corporate knowledge (knowledge management) to be stored and accessed as needed [12]. File sharing features ensure important documents are stored within a single system ecosystem, minimizing the risk of file loss or inconsistent document versions [13]. Meanwhile, internal video conferencing supports efficient virtual face-to-face meetings without the need for external applications, ensuring all activities are integrated within a single platform [14].

Beyond its functionality, this platform also supports increased company productivity [15]. With an internal collaboration system, decision-making can proceed more quickly because documentation, communication, and project discussions are available in a single digital environment [13], [16]. This aligns with the needs of companies that prioritize time efficiency and communication effectiveness as key indicators of performance improvement [17]. The use of an internal platform also helps build a more open, collaborative, and adaptive work environment to technological change [18].

## II. LITERATURES REVIEW

Several studies have examined the development of web-based collaboration systems to support organizational communication. Digital transformation has accelerated the use of hybrid and remote working models, requiring effective internal communication platforms. Previous research shows that centralized collaboration systems improve coordination, documentation, and productivity within organizations.

Studies applying the Waterfall method in system development indicate that this approach ensures clear requirement definition and systematic implementation, making it suitable for systems with well-defined scopes [19], [20]. Compared to previous studies, this research focuses on integrating chat, discussion forums, file sharing, and internal video conferencing into a single internal platform to reduce dependency on external applications and improve data security.

## III. FRAMEWORK

This research uses the Software Development Life Cycle (SDLC) approach with the Waterfall model, as this model provides a structured, systematic, and easily applicable workflow for software development with predetermined requirements and scope [21], [22]. This model consists of the

stages of requirements analysis, system design, implementation, testing, and maintenance. These stages are sequential, so each stage must be completed and validated before proceeding to the next.

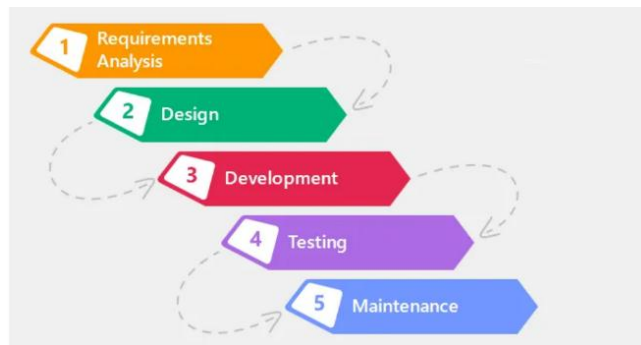


Figure 1. Waterfall Methods

IV. METHODS

The first stage is requirements analysis, the process of identifying the functional and non-functional requirements of an internal collaboration system. The analysis is conducted through direct observation of the company's communication processes and interviews with users from several divisions to identify required features, such as chat, discussion forums, file sharing, and video conferencing. The information obtained serves as the basis for determining the system design.

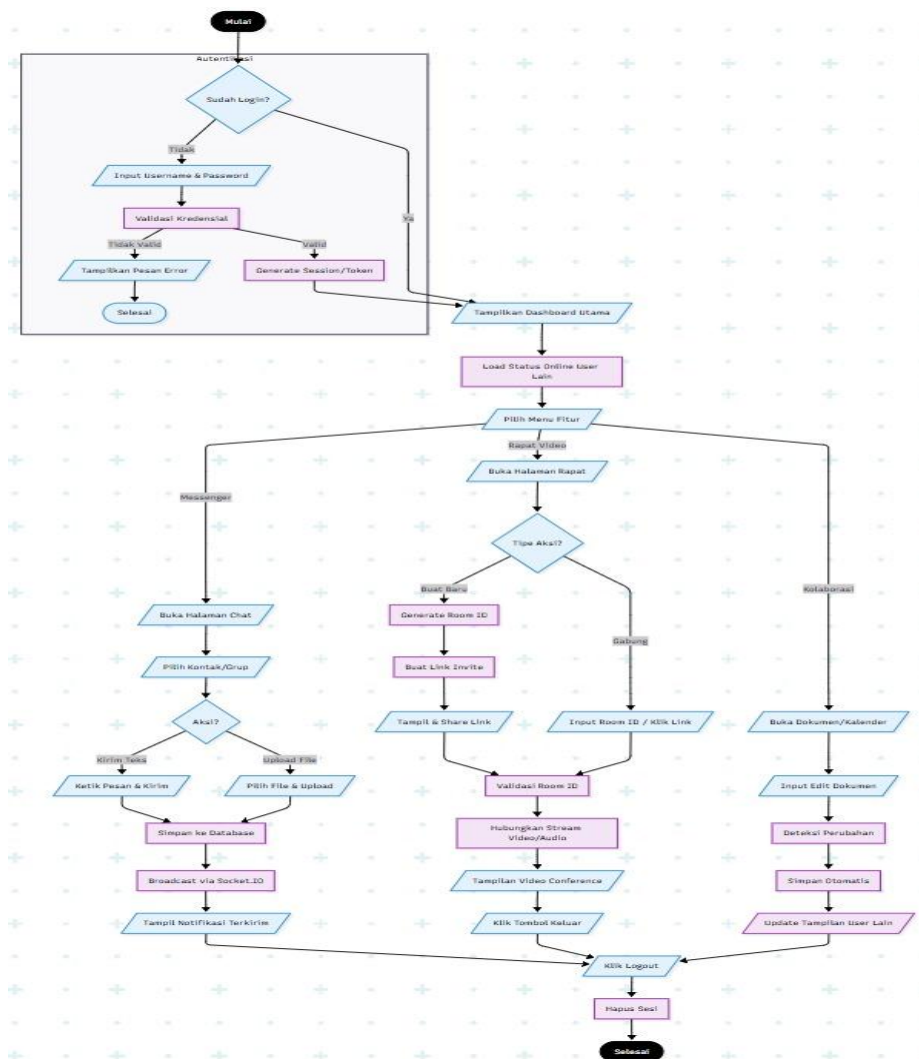


Figure 2. Flowchart Diagram

A flowchart is a visual aid used to illustrate the sequence of processes occurring within a system in a structured manner [23]. This diagram is used to map the logical flow, relationships between activities, and decisions that occur during user interaction with the system. In this study, a flowchart was used to illustrate the working processes of an internal collaboration system, which includes authentication, message communication, online meetings, and real-time document collaboration.

The flowchart in Figure 2 illustrates the overall operational flow of the system, from when a user first accesses the application to the process of logging out. The initial stage begins with an authentication process to ensure that only valid users can enter the application. After successfully logging in, the system displays the main dashboard as a navigation center for all features. From this page, users can select available services, such as messaging (chat), video-based online meetings, or real-time document collaboration. Each feature option has a different process flow according to its respective function. Modeling through this flowchart provides a sequential overview of the steps that occur in the system, making it easier for developers to understand the process structure and identify the functional components needed to support optimal system operation.

A Use Case Diagram illustrates the interactions between actors and the functions provided by the system [24]. In the designed internal collaboration and communication platform, there are four main actors: Owner, Admin, HR, and Staff. Each has different roles, responsibilities, and access rights according to the organization's operational needs. This use case modeling helps provide a structured overview of the system's functionality and the interaction boundaries of each actor.

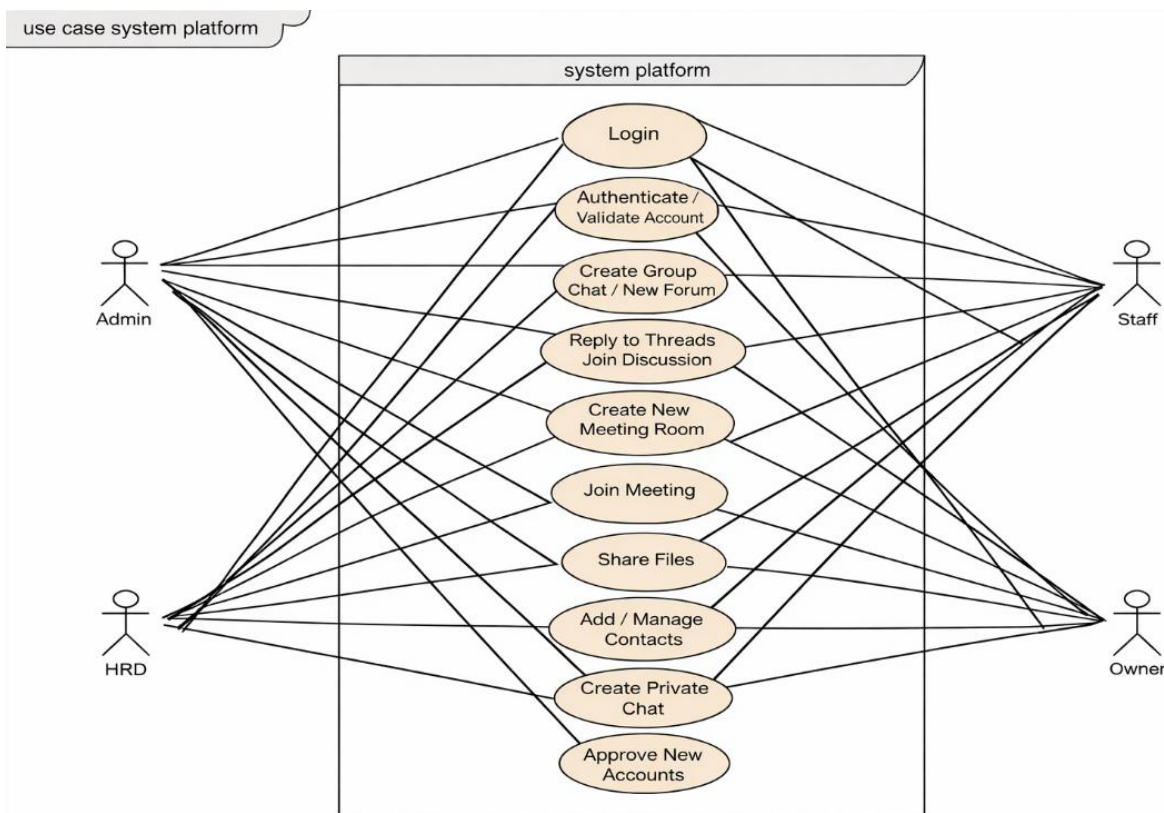


Figure 3. Use Case Diagrams

Activity diagrams are used to illustrate the sequence of activities that occur in each process within a system [25]. These diagrams show the sequence of actions performed by users and the system, including the decision flow and conditions that influence the process. In this study, activity diagrams were developed for several key features: login, chat, video conferencing, and collaborative documents.

The login activity diagram explains the authentication flow when a user logs into the system. The process begins when the user opens the login page and enters their username and password in the provided form. After the data is submitted, the system validates it by matching it with data stored in the database.

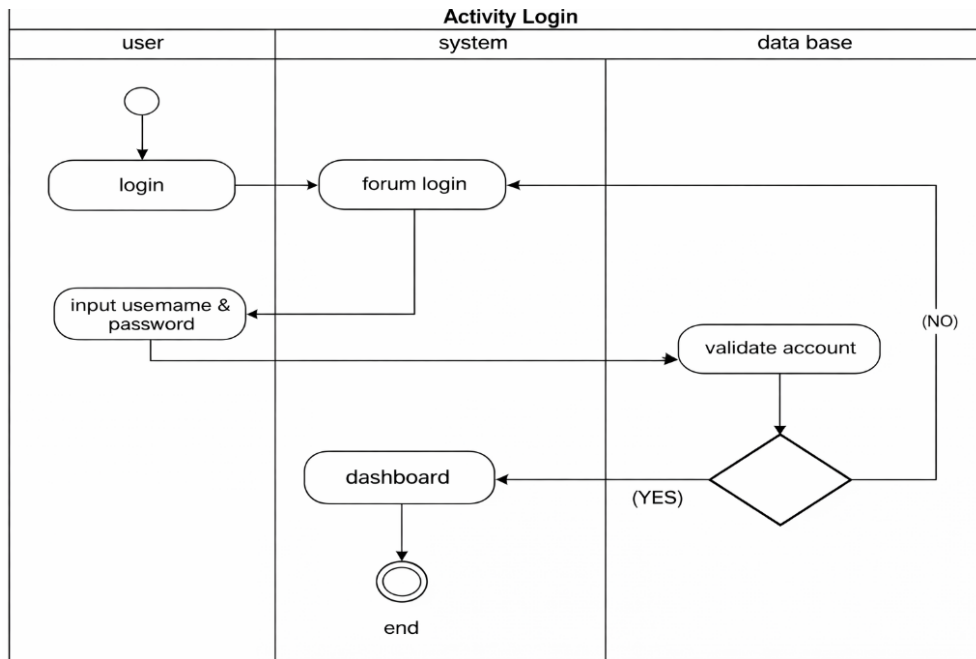


Figure 4. Activity Diagram Login

In the chat feature, activity begins when the user accesses the chat menu from the dashboard. The system displays a list of contacts or groups to choose from. After the user selects a recipient, the system opens a chat room. The user can type a text message or select a file to send. When a message is sent, the system first saves it to a database and then routes it to a real-time server to be displayed directly to the recipient. If the delivery process is successful, the message appears on the user's screen with a sent status. This process repeats as long as the user remains engaged in the chat room, ending when the user returns to the dashboard or closes the chat feature.

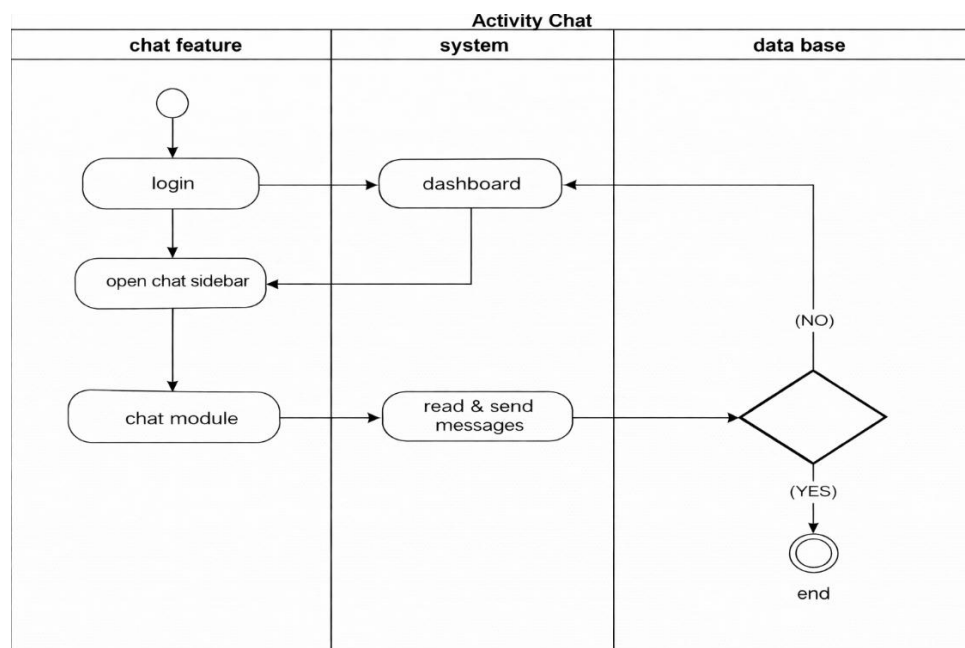


Figure 5. Activity Diagram Chat

In the chat feature, activity begins when the user accesses the chat menu from the dashboard. The system displays a list of contacts or groups to choose from. After the user selects a recipient, the system opens a chat room. The user can type a text message or select a file to send. When a message is sent, the system first saves it to a database and then routes it to a real-time server to be displayed directly to the recipient. If the delivery process is successful, the message appears on the user's screen with a sent status. This process repeats as long as the user remains engaged in the chat room, ending when the user returns to the dashboard or closes the chat feature.

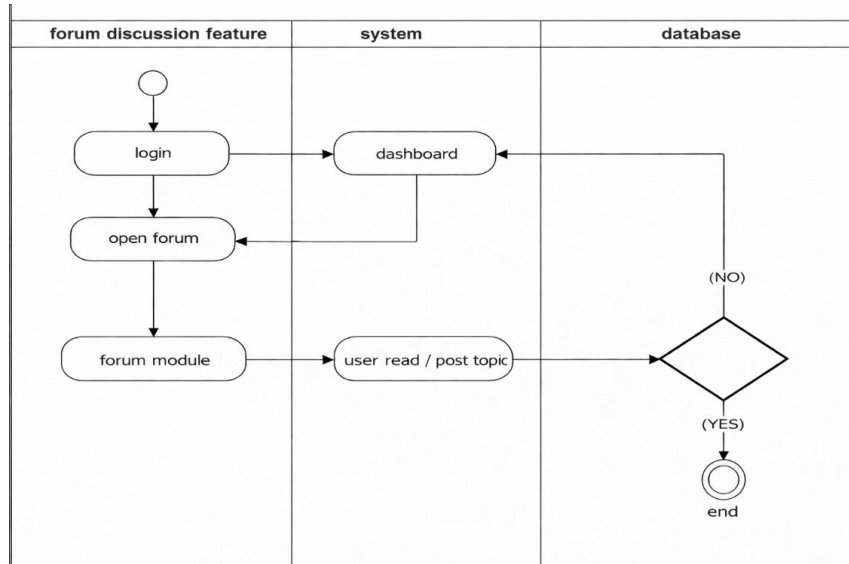


Figure 6. Discussion Forum Activity Diagram

In the video conference activity diagram, the process begins when a user opens the online meeting menu and chooses to create a new room or join using a Room ID. If creating a new room, the system generates a Room ID and displays an invitation link. If joining, the system checks the validity of the Room ID. Once validated, the system connects the user's camera, microphone, and network to the video server so that communication can take place in real time. The process ends when the user exits the meeting, and the system disconnects the connection and returns them to the dashboard.

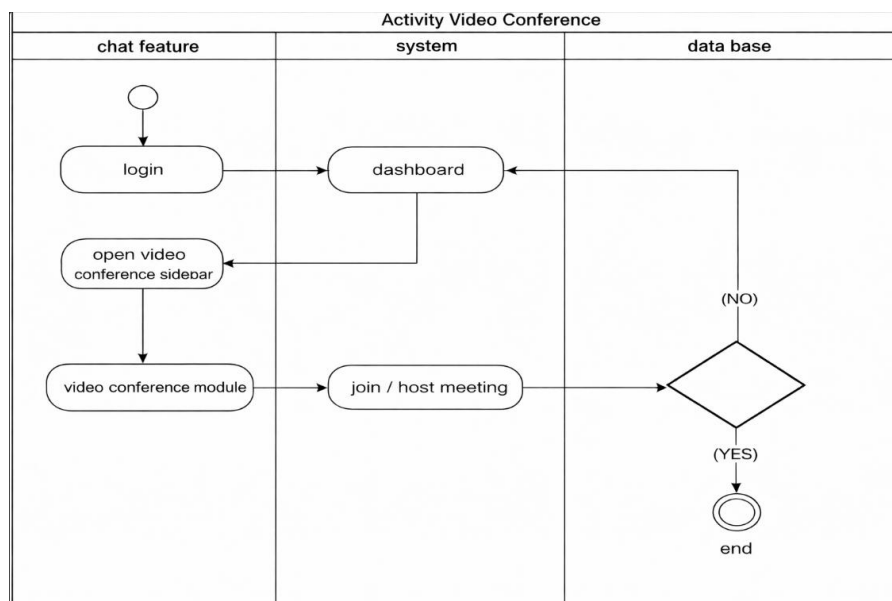


Figure 7. Video Conference Activity Diagram

The File feature activity diagram shows the flow of users managing and sharing files. The process begins when the user opens the File Sharing menu, and the system displays a list of uploaded files and their information. At this stage, the user can choose to upload new files, view files, download files, or delete files, depending on their access rights.

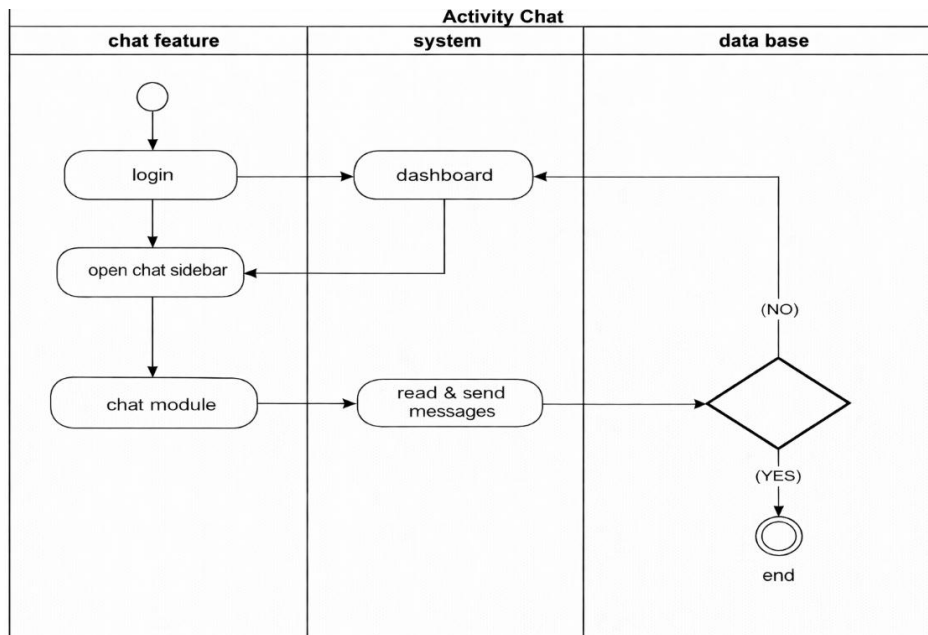


Figure 8. Files Activity Diagram

Sequence diagrams are used to depict sequential interactions between actors and systems. In this study, diagrams were created for the login, chat, video conference, and file sharing features. The sequence diagram of the login process illustrates the interaction flow between the user, system interface, application server, and database during authentication. The process begins when the user enters a username and password on the login page and submits the credentials to the system. The system interface forwards the login request to the application server for validation.

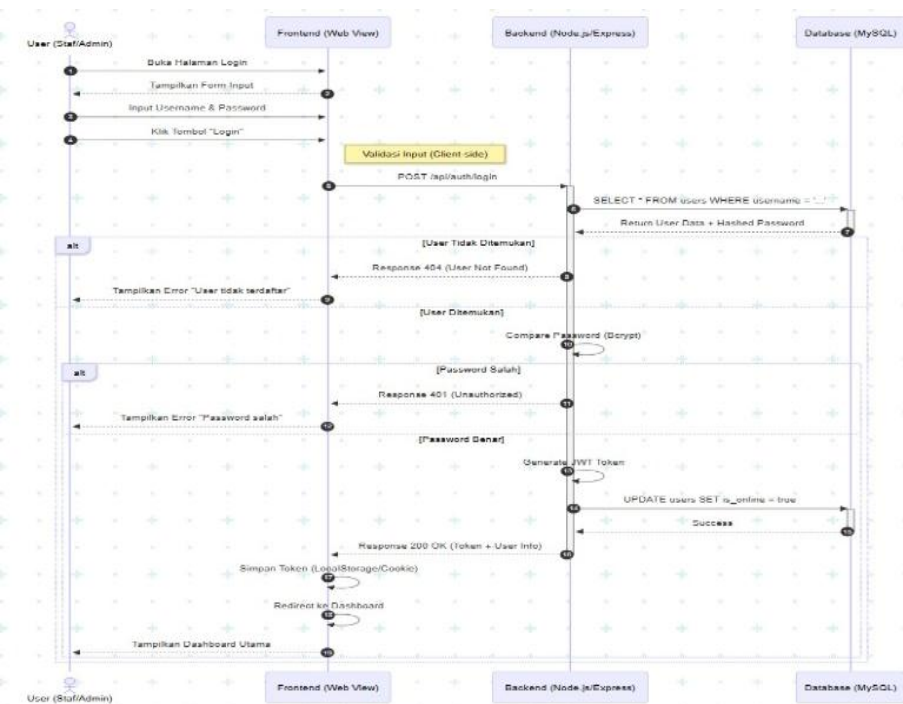


Figure 9. Sequence Diagram Login

The chat sequence diagram illustrates the message flow between the user, the system, the database, and the real-time server. After the user selects a chat and sends a message, the system saves the message to the database and then forwards it to the real-time server for immediate reception. The message appears instantly on the recipient's end, while the system displays a sent status to the sender. This diagram demonstrates a fast, synchronous, and documented message exchange process.

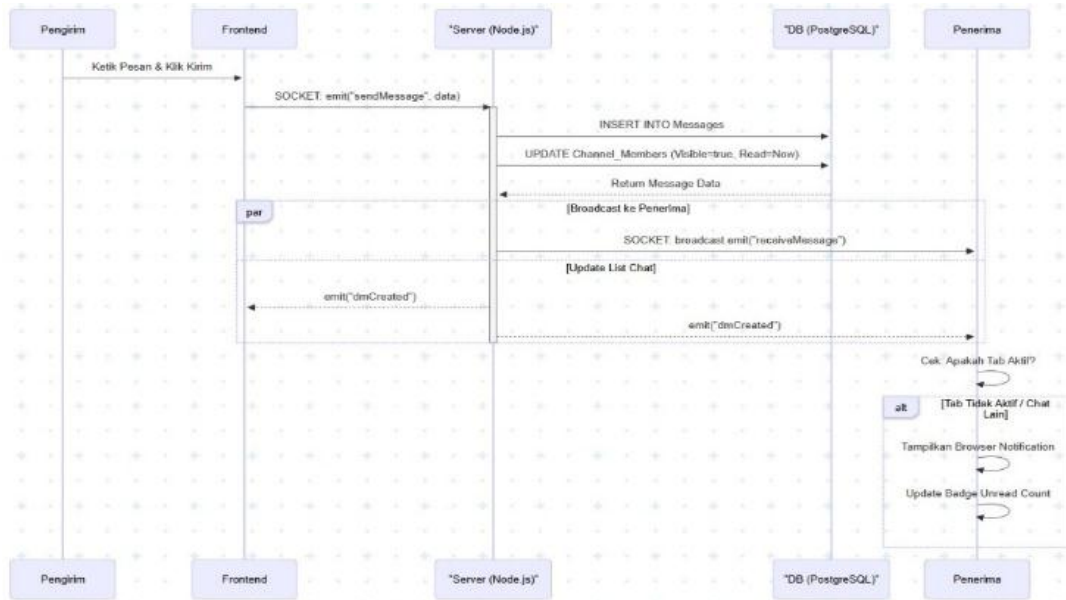


Figure 10. Sequence Diagram Chat

The video conference sequence diagram illustrates the flow when a user opens the online meeting menu and then chooses to create a new room or join using a Room ID. If a new room is created, the system generates a Room ID and stores it before displaying the invitation link. If a user joins, the system verifies the Room ID against the database. Once validated, the system continues the connection process to the video server to start the online meeting.

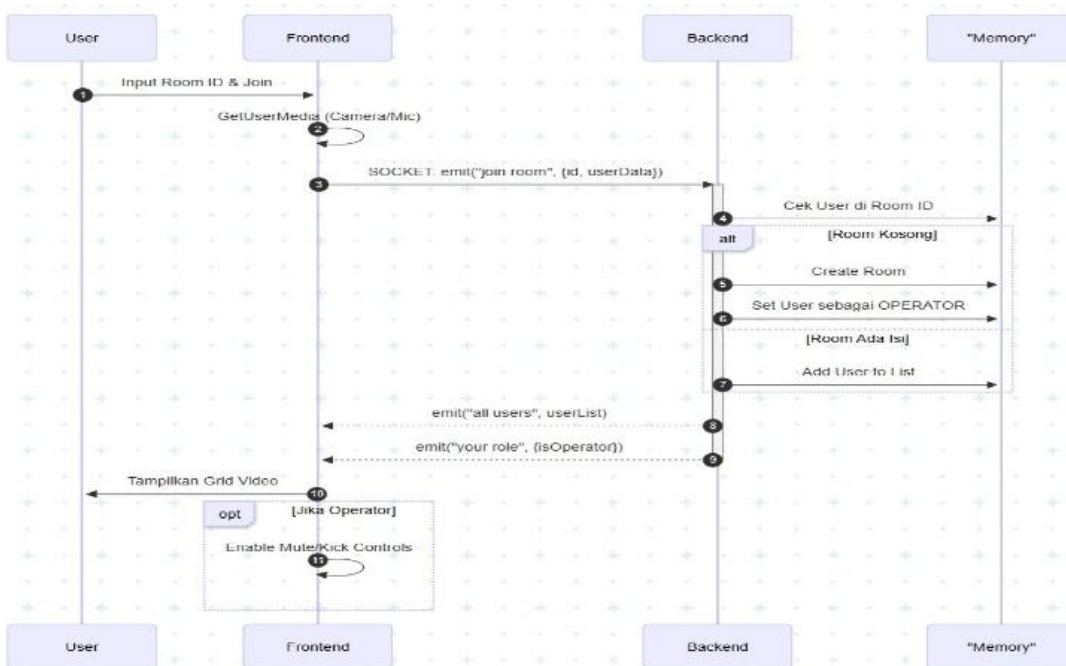


Figure 11. Video Conference Sequence Diagram

The admin dashboard interface is designed as a central hub for user control, access rights, and collaboration system data, including messenger, meetings, documents, files, calendar, and contacts modules. A navigation sidebar is located on the left side to easily navigate between menus such as Messenger, Meetings, Docs, Files, Calendar, Contacts, and the Admin Panel. The Admin Panel is selected as the primary menu for managing users and system requests.

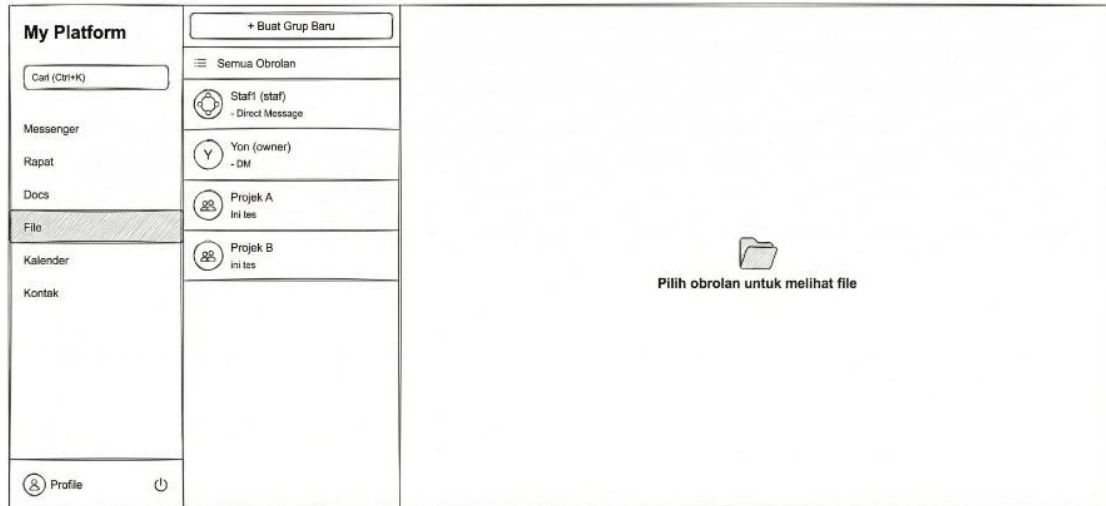


Figure 12. Interface Design System

V. RESULT

The results of system implementation in the form of a user interface (UI). The entire interface is designed with usability, information clarity, color matching, and visual element consistency in mind to ensure an intuitive user experience. This section focuses on explaining the interface, layout structure, button functions, and how these elements are arranged to achieve the intended use.

System test results

This chapter discusses the implementation results of the Collaboration & Communication platform, which includes chat features, discussion forums, file sharing, and internal video conferencing. The research results include the realization of the system design, interface implementation, and testing of key functionalities according to user needs. Evaluation was conducted to ensure that the system functioned as intended, namely facilitating efficient internal communication and collaboration within a single, integrated platform.

Table 1. System Test Results

Feature	Test Scenario	Expected Result	Test Result
Login	User enters username and password	Successfully logged in	Successful
Login	Invalid data entered	Error message appears	Successful
Registration	Complete and valid data	Account is created	Successful
Chat	Sending text messages	Messages appear in real time	Successful
Chat (File Transfer)	Sending a file	File sent without failure	Successful
Video Conference	Creating a room ID	Room ID appears and is valid	Successful
Video Conference	Joining a meeting	Connected to video	Successful
Document	Real-time editing	Changes are synchronized	Successful
Calendar	Adding an agenda	Agenda appears in the calendar	Successful
Contact	Sending contact message	Data is saved	Successful

Login and Registration Page View

The login interface features a clean design with a primary focus on two components: the input field and the action button. The input fields are arranged vertically with proportional spacing between elements to ensure high readability. The background color is kept simple to allow text and

interactive elements to stand out. The login button has a contrasting color to direct the user's attention to the next step.

Meanwhile, the registration screen features several additional fields, such as full name, email address, and password confirmation. These elements are neatly arranged to create a natural flow. Each input field is marked with a placeholder to help users understand the correct data format. This page's design is consistent with the login page to provide a sense of familiarity when users first register.

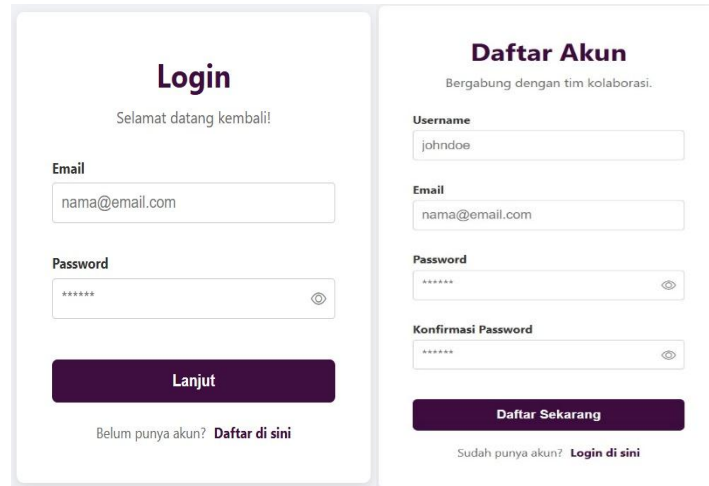


Figure 13. Login View and Registration View

### Chat Page Display

The chat page interface is designed to resemble a modern messaging app, with two main sections. The left panel displays a list of conversations, complete with contact names and previews of recent messages. The right panel serves as the space for reading and sending messages.

Each message is displayed using a bubble with a different color to distinguish the sender and recipient. The message input area is located at the bottom and includes icons for sending files, images, or attachments. This design provides a familiar conversational experience that users can quickly adapt to. This layout also prioritizes text readability by selecting the right font size and providing sufficient space between chats.

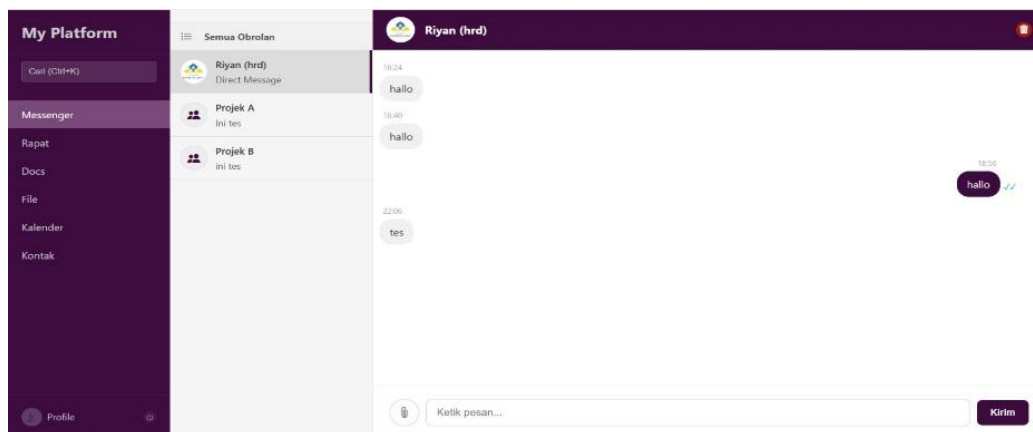


Figure 14. Chat Page Display

### Display the Video Conference Page

The video conference interface displays the main video area, showing the user's camera and other participants joining the meeting. It also features a list of participants on the side of the screen, along with controls such as buttons to enable or disable the camera, microphone, and screen sharing. The interface is designed to be simple so users can easily follow the meeting without any

issues. This feature serves as a means of virtual face-to-face communication, allowing users to conduct meetings, presentations, or discussions without having to meet in person.

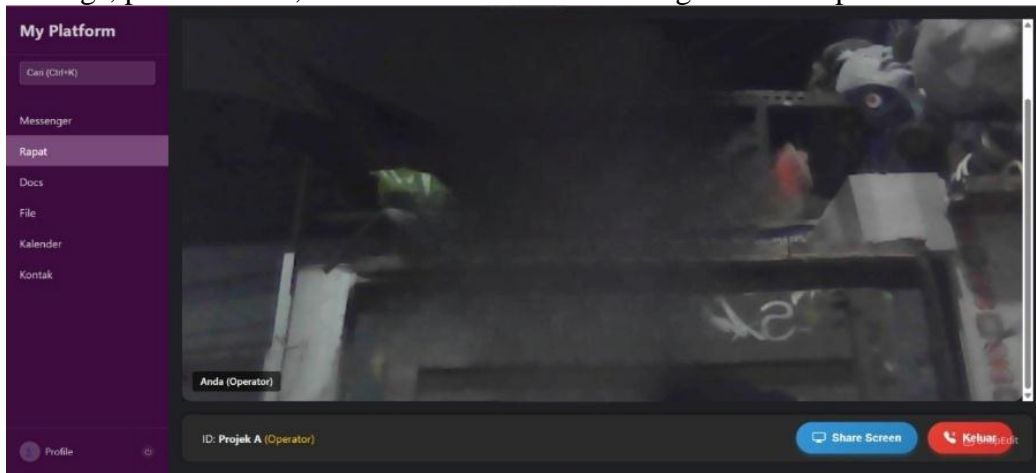


Figure 15. Display Video Conference Page

### Display File Page

The file upload view displays a list of uploaded documents, complete with name, size, and date. Users can add new files using a simple and easy-to-use upload button. This feature serves as a centralized repository for sharing documents according to access rights. The system works well, accepting files that meet the size limit, rejecting those exceeding the limit with a notification, and immediately displaying successfully uploaded files and allowing for seamless re-downloading.

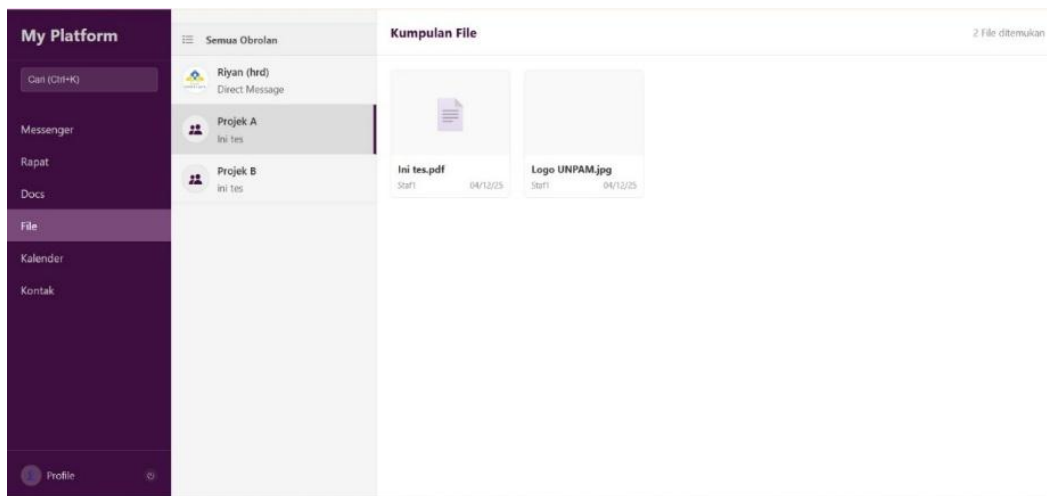


Figure 16. Display File Page

### Document Page View

The collaborative document page provides a word-processing-like editor with basic toolbars for bold, italic, underline, insert, and delete. Documents appear with a white background and standard margins for comfortable reading and editing. A key feature is the active user indicator, which displays the edit positions of other users in real time, with a different color for each user. This interface is designed to make collaboration feel natural and fluid, similar to editing documents offline.

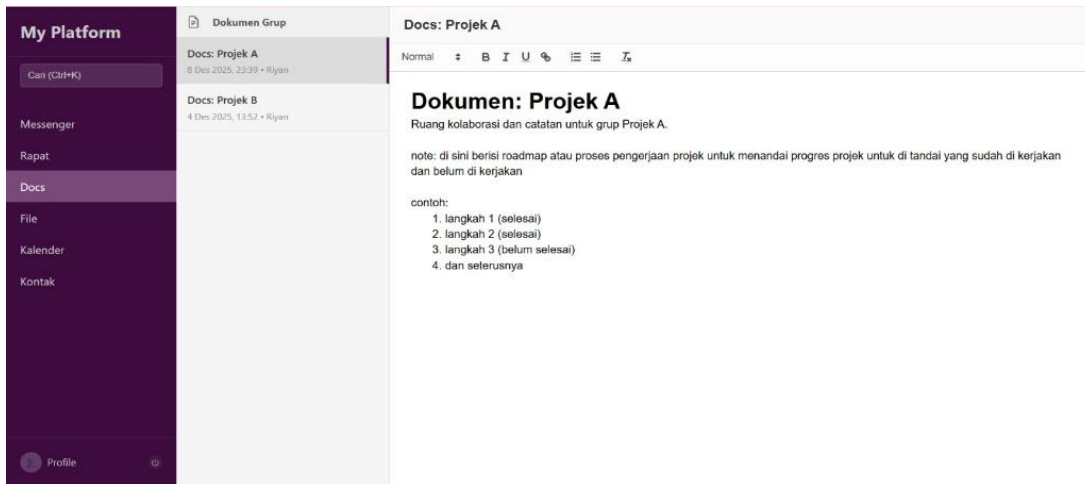


Figure 17. Document Page View

**Entity Relationship Diagram**

An ERD helps visually depict a system's database structure, making it easier to design the database and understand how data interacts within the system. Using an ERD allows developers and other teams to more easily design the system and ensure that the relationships between data align with the application's needs.

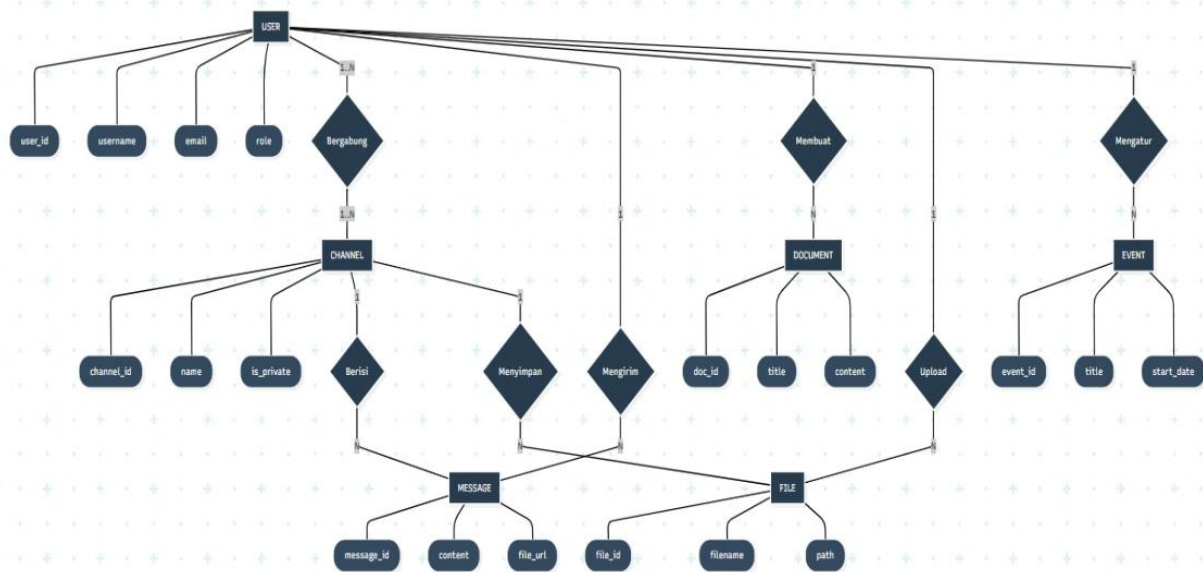


Figure 18. Entity Relationship Diagram

**VI. DISCUSSION**

The discussion interprets the empirical results of the system implementation and testing in relation to established theories in digital collaboration, human-computer interaction, and organizational communication. The successful operation of all core features real-time chat, discussion forums, file sharing, collaborative documents, calendar management, and internal video conferencing indicates that the integrated platform effectively addresses the communication and coordination problems commonly found in hybrid and remote working environments. These findings support earlier claims in the Introduction regarding fragmented information flow, unstructured documentation, and excessive dependence on third-party applications. In line with Leonardi and Keppler’s argument that digital platforms enhance knowledge sharing and relational confidence within distributed teams, the system developed in this study demonstrates its capability to centralize interactions and institutionalize organizational knowledge.

From a comparative perspective, the results both align with and extend prior research on collaboration platforms. Studies such as Alone et al. on real-time collaboration for remote work which integrate chat, video conferencing, and document editing demonstrate the effectiveness of multi-feature platforms in supporting distributed teams. Similarly, cloud-based collaborative workspaces that combine communication channels, video conferencing, voice messaging, and file sharing show that feature integration can reduce tool fragmentation and improve productivity [13]. Groupify further reinforces the value of real-time collaboration tools for group coordination [16]. However, most of these platforms are designed as general-purpose or cloud-dependent solutions. In contrast, the present study focuses specifically on an internal organizational context, emphasizing the reduction of dependency on external applications and the integration of collaboration features within a single controlled ecosystem. The explicit modeling of organizational roles (Owner, Admin, HR, Staff) and the use of an internal architecture tailored to corporate workflows position this platform as a more domain-specific and governance-aware alternative to generic collaboration tools.

The system's performance also validates the appropriateness of the Waterfall model used in the development process. Each sequential stage from requirements analysis to design, implementation, and testing showed alignment between users' expressed needs and the features implemented. The clarity of requirements obtained through initial observation and interviews played a key role in achieving this consistency. This finding is consistent with prior studies that highlight the suitability of Waterfall for systems with well-defined functional scopes and minimal requirement volatility. The comprehensive modelling (flowcharts, use case diagrams, activity diagrams, sequence diagrams, and ERD) supported the systematic development process by providing clear references for both developers and evaluators, thereby reducing ambiguity during implementation.

The real-time chat and file-sharing functionalities were perceived as the most impactful features due to their role in facilitating both synchronous and asynchronous communication. Users experienced the messaging interface as familiar, resembling contemporary communication tools, which accelerated adoption and reduced cognitive effort. This observation is in line with previous findings that interface familiarity and visual consistency contribute to lower learning curves and more efficient task completion in collaborative systems [13]. The collaborative document editor further enhanced user experience by enabling multi-user editing, a capability widely associated with cloud-based productivity tools, yet implemented here within an internally managed environment. Unlike purely cloud-hosted solutions, this internal architecture reduces exposure to external data policies and supports stricter organizational security and compliance requirements.

The testing results also provide important insights related to system reliability and robustness. All features performed as expected, with functional tests showing consistent success across login validation, registration, meeting-room generation, real-time chat, file transfer, and synchronized collaborative document editing. These outcomes reflect a stable integration between the application server, database, and real-time communication mechanisms. Nevertheless, observational feedback suggests opportunities for refinement, particularly in terms of responsiveness under fluctuating network conditions, clearer loading indicators, and more explicit error-handling for large file operations. Similar to public-sector and enterprise platforms studied previously, minor delays and ambiguous feedback can undermine user confidence even when core functionality remains intact, underlining the importance of transparent system status and feedback mechanisms in collaborative environments.

Interpreted through the lens of user experience theory, the integrated platform demonstrates a strong relationship between usability and organizational performance outcomes. By consolidating communication channels and document workflows into a single environment, the platform reduces task switching and minimizes the fragmentation of work-related information. This is consistent with models of UX and productivity which emphasize that reduced friction in digital interactions contributes not only to efficiency but also to positive affective responses and higher perceived

service quality. The presence of structured discussion forums and centralized file management additionally supports knowledge retention and long-term organizational memory, aspects that tend to be weak in organizations relying solely on ad hoc messaging tools.

Despite its overall success, this study has several limitations that warrant acknowledgment. First, the evaluation focused primarily on functional correctness rather than employing standardized usability instruments such as SUS, UEQ, or heuristic evaluations. Incorporating these instruments in future work would provide richer insight into perceived usability, hedonic quality, and emotional responses. Second, the study did not report formal performance or stress testing under high user loads, limiting conclusions about scalability in large organizations. Third, the platform was evaluated within a limited organizational context; broader deployment across different sectors or institutional cultures could reveal additional requirements or constraints not captured in this research.

From a broader perspective, the results of this study reinforce the strategic importance of internal collaboration platforms as core infrastructure in digital transformation initiatives. By centralizing communication, documentation, and virtual meetings, organizations can improve transparency, accelerate decision-making, and reduce operational dependence on heterogeneous external tools. Compared to prior works that primarily emphasize remote-work enablement or generic real-time collaboration, this study contributes a design and implementation blueprint for an internally governed, role-aware collaboration ecosystem that can be adapted to specific organizational policies and structures. Future research could extend this work by integrating analytics dashboards to monitor collaboration patterns, applying AI-assisted recommendation mechanisms for document and discussion retrieval, and conducting longitudinal studies to measure productivity, satisfaction, and communication quality before and after system adoption.

In summary, the heuristic and functional evidence indicates that the integrated collaboration and communication platform effectively fulfills its intended purpose and contributes positively to organizational communication practices. While further usability, scalability, and cross-context evaluations are needed, the system already exhibits strong functional performance and provides a differentiated contribution compared to existing collaboration tools by emphasizing internal integration, governance, and role-specific access control. These insights move the reader's understanding beyond the Introduction by demonstrating how a systematically developed, domain-oriented platform can operationalize digital collaboration theories within real organizational settings.

## VII. CONCLUSION

This study presents the design and implementation of an integrated internal collaboration and communication platform that unifies chat, discussion forums, file sharing, collaborative document editing, calendar management, and internal video conferencing into a centralized system. Guided by the Software Development Life Cycle (SDLC) using the Waterfall model, the development process proceeded through sequential stages of requirement analysis, system design, implementation, and testing. The system was evaluated through functional testing, all of which confirmed that the implemented features performed reliably and aligned with user expectations, thereby demonstrating the feasibility of creating a unified digital workspace tailored for organizations operating in both hybrid and remote environments.

The results indicate that the platform effectively addresses persistent organizational challenges such as information delays, fragmented communication channels, undocumented coordination, and dependence on multiple third-party applications. Real-time communication features, combined with structured asynchronous tools such as discussion forums and centralized file management, enable more seamless knowledge sharing and coordination. This aligns with prior findings suggesting that integrated collaboration systems enhance workflow coherence, reduce cognitive load, and strengthen institutional documentation practices. Moreover, the system's familiar and intuitive

interface supports rapid user adoption and contributes positively to overall usability and workplace efficiency.

Despite these achievements, several limitations were identified. The evaluation focused primarily on functional correctness rather than incorporating standardized usability metrics such as SUS, UEQ, or heuristic assessments. Scalability and performance testing under higher user loads were also not conducted, limiting the generalizability of system stability across larger organizational contexts. Additionally, the platform was assessed within a single institutional environment, which may not fully capture the diverse needs and interaction dynamics present across different sectors or organizational cultures. These constraints present opportunities for refinement and expansion in future research.

Future work should consider integrating comprehensive usability testing methods, stress-testing under various network conditions, and expanding the system to support adaptive features such as user personalization, AI-assisted document recommendations, or analytics dashboards for monitoring collaboration patterns. Broader deployment across multiple organizations would also provide comparative insights and strengthen the empirical foundation regarding the platform's impact on productivity, communication quality, and organizational knowledge management. Longitudinal studies evaluating pre- and post-adoption performance indicators would further deepen understanding of the system's long-term contributions to digital transformation initiatives.

Overall, this research provides a structured model and a functional prototype for organizations seeking an internally governed, secure, and unified collaboration ecosystem. By consolidating communication and documentation workflows within a single platform, this study contributes to ongoing efforts to build more connected, efficient, and technologically adaptive work environments, while also identifying critical pathways for future enhancement and scalability.

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