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Office Application with Google Calendar and AI Chatbot Integration for PT Pertamina Hulu Rokan Based on Flutter

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Abstract *– Effective office management is essential for improving organizational efficiency in the Industry 4.0 era. At PT Pertamina Hulu Rokan, the lack of a mobile-based system has led to fragmented data management, poor schedule coordination, and limited real-time communication, resulting in operational inefficiencies. To address these issues, this study develops a Office Application with Google Calendar and AI Chatbot Based on Flutter integration as a comprehensive digital solution to modernize office management. Flutter was chosen because it enables cross-platform development using a single codebase for both Android and iOS, reducing development time and maintenance costs while maintaining consistent performance. The system integrates Firebase for secure authentication and data management, Google Calendar API for automatic schedule synchronization, and an AI-powered chatbot for intelligent, automated communication. Developed using the Agile methodology, the application underwent iterative refinement and testing to ensure reliability and usability. The results show that the system enhances coordination, strengthens internal communication, and improves administrative efficiency. This research demonstrates that implementing Flutter with Google Calendar and AI Chatbot provides an effective, scalable approach to achieving digital transformation in large industrial organizations.*

Keywords – Flutter, Smart Office, AI Chatbot, PT Pertamina Hulu Rokan, Agile Methodology, Google Calendar API

I. INTRODUCTION

In the era of Industry 4.0, organizations are increasingly required to adopt advanced digital solutions to enhance operational efficiency and competitiveness [19]. Effective office management is central to achieving these goals, as it ensures structured coordination, accurate information handling, and seamless communication across departments [18]. However, PT Pertamina Hulu Rokan, one of Indonesia's largest upstream oil and gas companies, still relies on conventional, fragmented, and non-integrated administrative practices. The absence of a mobile-based office management system has led to inefficiencies in managing schedules, difficulties in coordinating employee activities, and limited real-time communication—all of which negatively impact productivity and decision-making processes [19][20].

Previous studies on office digitalization have introduced web-based administrative systems and Enterprise Resource Planning (ERP) solutions to address such inefficiencies. ERP systems are designed to integrate various organizational processes—such as finance, human resources, and operations—into a single centralized platform to improve coordination and data consistency. While ERP solutions are effective for enterprise-level management, they are often complex, expensive, and primarily desktop- or web-based, making them less flexible for real-time mobile use and less suited to handle dynamic office workflows [12][14]. Consequently, ERP systems are not ideal for organizations that require portable, user-friendly, and intelligent mobile tools to manage day-to-day administrative operations.

To overcome these limitations, this study proposes the development of a Office Application with Google Calendar and AI Chatbot Integration Based on Flutter designed specifically for PT Pertamina Hulu Rokan. Flutter was selected as the development framework because it enables cross-platform deployment using a single codebase for both Android and iOS devices. This approach reduces development time, cost, and complexity compared to native or hybrid frameworks such as React Native or Kotlin .

Moreover, Flutter uses the Skia graphics engine, which ensures high-performance rendering, consistent user interfaces, and smooth animations across platforms. Its strong compatibility with Firebase and Google APIs allows for real-time synchronization, secure data management, and scalable backend integration, making it highly suitable for enterprise-level mobile applications [3][4][5].

The integration of the Google Calendar API enhances scheduling efficiency by automatically synchronizing meetings and activities, reducing conflicts and improving time management [8][9]. Meanwhile, the AI-powered chatbot provides intelligent and automated communication, allowing employees to retrieve information, manage tasks, and interact with the system quickly and effectively [1][2]. Together, these components create a smart, efficient, and unified office management ecosystem that directly supports PT Pertamina Hulu Rokan's digital transformation objectives.

This research employs the Agile Software Development Methodology, which emphasizes iterative design, user collaboration, and adaptability to changing requirements [12][13]. Agile was chosen because it allows for continuous evaluation and user feedback, ensuring that the system remains aligned with organizational needs. The research began with a needs assessment, conducted through interviews with ten administrative and IT staff members from PT Pertamina Hulu Rokan to identify operational challenges and user expectations. The insights obtained guided the system design and prototyping process using Flutter, followed by testing and evaluation under both normal and abnormal conditions to ensure system reliability, usability, and performance.

The objective of this study is to design and develop an integrated Office Application with Google Calendar and AI

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Chatbot that combines scheduling, communication, and employee data management in a single, efficient mobile platform. The scientific contribution of this research lies in demonstrating how the combination of Flutter's cross-platform framework, AI-driven interaction, and cloud-based synchronization can effectively modernize office management. Furthermore, this study provides a scalable and adaptive model for digital office transformation in large industrial organizations, aligning with global trends toward smart, connected, and data-driven workplaces [18][19][20].

II. RESEARCH METHODOLOGY

The development of the Office Application for PT Pertamina Hulu Rokan employed the Agile Software Development Methodology, a framework well-suited for projects requiring flexibility, adaptability, and continuous refinement. Agile is an iterative and incremental development approach that focuses on delivering functional software in small, manageable segments called sprints. Each sprint produces a working version of the application that can be tested, reviewed, and refined before proceeding to the next cycle. This methodology promotes active collaboration between developers and end-users, ensuring that the system evolves in alignment with user needs and organizational goals. Agile was selected for this project because it allows continuous feedback, rapid adaptation to change, and effective management of complex mobile application development processes where requirements may evolve over time [12].

The Agile methodology is based on four core principles outlined in the Agile Manifesto: (1) prioritizing individuals and interactions over processes and tools, (2) focusing on working software over extensive documentation, (3) encouraging customer collaboration over contract negotiation, and (4) responding to change over following a fixed plan. In this study, these principles were applied through continuous communication with PT Pertamina Hulu Rokan's administrative and IT teams. Regular feedback loops were established during each sprint, allowing iterative design improvements, efficient testing, and early issue identification. This approach significantly reduced development risks and ensured that the resulting system met user expectations both functionally and visually.

The development process began with a planning phase, during which the organization's core requirements were identified. These included secure user authentication using Firebase, schedule synchronization through Google Calendar, and the integration of an AI-powered chatbot to assist employees in efficiently accessing internal information [8]. Following this, the design phase focused on developing a clean and professional user interface, leveraging Flutter's cross-platform capabilities to ensure seamless operation across both Android and iOS devices [16].

In the development phase, application features were implemented incrementally and assessed through short testing cycles. This iterative approach enabled early identification and resolution of potential issues, minimizing risks and improving system reliability. Testing was performed under both normal conditions (such as valid login attempts or successful schedule entries) and abnormal conditions (such as invalid credentials or network interruptions), ensuring system robustness and stability [10][15].

Finally, the implementation phase involved deploying the application prototype for real-world use within PT Pertamina Hulu Rokan's operational environment while maintaining flexibility for future enhancements and additional feature development [19][20]. To provide a structured overview of this study, the research framework for the Flutter-Based Office Application is illustrated in Figure 1, which presents the overall flow of the research process beginning from problem identification and system requirement analysis, followed by design, development, testing, and final implementation according to the Agile methodology [12][13].

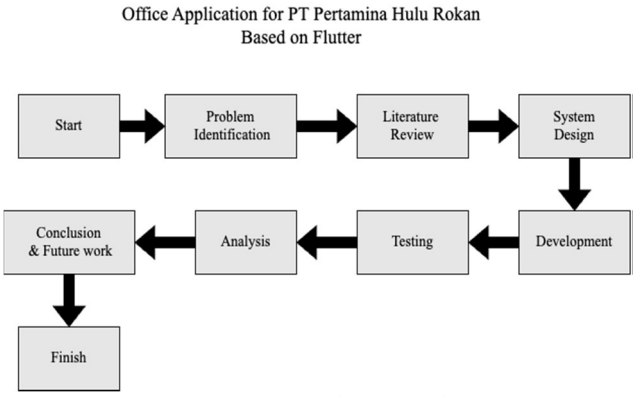

Figure. 1 Research Framework

A. Data Collection and Source

The data used in this study was obtained exclusively through online interviews conducted with members of the Information Technology (IT) Department of PT Pertamina Hulu Rokan. Since the researcher was located far from the company's operational office in Riau, Indonesia, direct field observations or face-to-face interviews could not be carried out. Therefore, data collection was conducted entirely through WhatsApp online communication, which provided an efficient, flexible, and reliable method of gathering information while maintaining continuous interaction between the researcher and respondents. This approach ensured that distance did not become a limitation in obtaining detailed and accurate data relevant to the research objectives.

Two IT staff members participated in the interview process, both of whom were directly responsible for managing and maintaining the company's internal digital infrastructure, including administrative systems, data management platforms, and employee communication tools. Their active involvement in daily system operations provided valuable insights into the company's workflow and highlighted the real challenges encountered in managing office activities. The interviews were conducted in a semi-structured format, allowing the respondents to express their perspectives freely while the researcher guided the conversation toward specific topics related to digital transformation and office system integration.

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During the interviews, the respondents explained in detail the existing problems within the current office management system, particularly issues related to fragmented data handling, difficulties in synchronizing meeting schedules, and the lack of a centralized communication platform that connects various administrative activities. They also discussed limitations in employee data accessibility, the inefficiency of manual processes, and the need for an integrated application that supports mobile access and real-time synchronization. The participants emphasized that the absence of a unified system had a direct impact on productivity, coordination, and timely information sharing among departments. Additionally, the discussion explored the respondents' expectations for a modern digital solution that would provide secure authentication, easy navigation, reliable cloud integration, and AI-assisted communication.

The information gathered through these WhatsApp interview sessions served as the main empirical foundation for this research. All insights obtained were carefully analyzed to identify recurring themes and key requirements that shaped the system's design and functionality. The findings directly guided the conceptualization and development of the Office Application with Google Calendar and AI Chatbot Based on Flutter, which was designed to address the identified challenges and improve office management efficiency within PT Pertamina Hulu Rokan.

Overall, the use of online interviews via WhatsApp proved to be an effective and adaptive data collection method. It enabled the researcher to maintain interactive communication despite geographical limitations while ensuring that the data collected was relevant, accurate, and comprehensive. This approach not only provided a clear understanding of the organization's operational challenges but also aligned with the broader context of digital transformation, where technology facilitates collaboration and research in a remote setting.

B. Data Collection Period

The data collection was conducted from March to May 2025, coinciding with the initial stages of system design and requirements analysis. During this period, the researcher focused on gathering supporting documents and relevant literature as the foundation for designing the office application system.

C. System Architecture

The system architecture provides a comprehensive overview of the structure of the developed application, including how the main components interact with one another to form a complete and efficient system. In the development of the Office Application for PT Pertamina Hulu Rokan, the architecture follows the principles of a client–server architecture, combined with a modular and layered design approach to ensure scalability, maintainability, and efficient performance. The figure below illustrates the system architecture diagram used in this study.

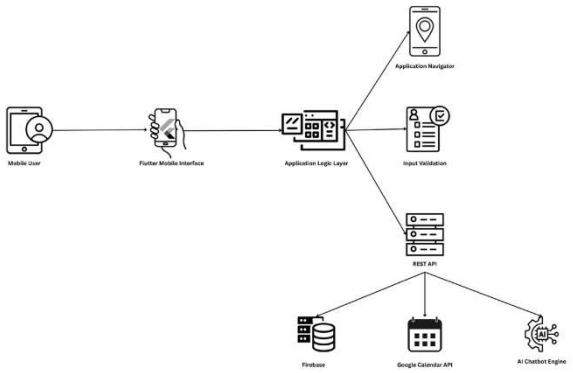

Figure. 2 Architecture Diagran System

D. System Design

The System Design phase outlines the overall structure and operational flow of Office Application for PT Pertamina Hulu Rokan. This stage aims to describe how the system's core components interact and how data moves across different modules to ensure efficiency, accuracy, and consistency in every process. The design was developed based on the results of the system analysis and implemented using the Unified Modeling Language (UML), which serves as an international standard for visualizing, specifying, and documenting software architecture. One of the main UML models used in this study is the Activity Diagram, which illustrates the sequential flow of processes within the application, including user interactions, system responses, and decision points.

In this project, the Activity Diagram represents the logical workflow of essential functions such as user authentication, meeting schedule management, and calendar synchronization using the Google Calendar API, as well as chatbot interactions powered by AI technology . Each activity reflects a system operation or user task that contributes to a seamless digital office management experience. The diagram provides a dynamic view of how the application handles user inputs, system decisions, and process execution from start to finish, ensuring that the system design supports both usability and organizational efficiency.

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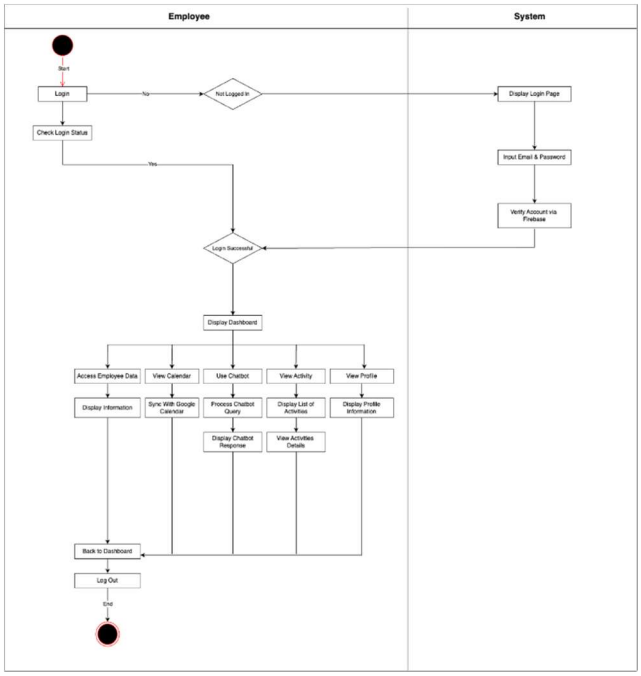

Figure. 4 Activity Diagram System

E. Testing Phase

The testing phase aimed to ensure that the Office Application with Google Calendar and AI Chatbot functioned effectively and reliably under both normal and abnormal operating conditions. Testing was conducted to validate the accuracy, stability, and user experience of the system across all major modules, including authentication, scheduling, chatbot interaction, and data synchronization.

Testing was divided into two categories: functional testing and non-functional testing. Functional testing focused on verifying that all core features operated according to their intended purposes. This included evaluating user login authentication, registration, calendar synchronization, chatbot interaction, and data retrieval from Firebase. Non-functional testing assessed performance, stability, and fault tolerance, including the system's ability to maintain operation during network interruptions.

Table. 1 Application Testing Result

No	Application Testing Result			
	Test Scenario	*Expected Result*	*Actual Result*	*status*
1.	User Login with valid credentials	User successfully logs into the system	Successful login	Passed
2.	User Login with invalid credentials	System displays an error message	Error message displayed correctly	Passed
3.	Registration with new account	New user account created and stored in Firebase	Account successfully registered	Passed
4.	Schedule creation in Calendar	Schedule saved and synchronized with Google Calendar	Event successfully added	Passed
5.	Chatbot inquiry (AI feature)	Chatbot provides relevant automated response	Response displayed correctly	Passed
6.	Data retrieval from Firebase	Data loaded accurately and promptly	Data displayed as expected	Passed
7.	Network disconnection during operation	Application displays "Network Error" message	Error message displayed, system remains stable	Passed
8.	Profile update by user	Changes saved and reflected in profile data	Profile updated successfully	Passed
9.	Application launch performance	Splash screen and dashboard load within 3 seconds	Loaded within target time	Passed
10.	Logout function	User session terminated and redirected to login page	Function works properly	Passed

The testing results confirmed that all core features of the Office Application functioned effectively and met the predefined system requirements. The user authentication module accurately verified valid credentials and prevented unauthorized access, while the registration feature integrated successfully with Firebase for secure data storage. The Google Calendar synchronization operated seamlessly, enabling real-time event creation without delays, and the AI Chatbot consistently delivered relevant automated responses, validating the success of the conversational interface. Furthermore, data retrieval from Firebase was fast and accurate, ensuring stable real-time performance, and the system remained reliable during network disconnection tests, displaying proper error messages while preserving local data integrity. Overall, both functional and non-functional evaluations demonstrated that the application operates reliably, delivers a smooth user experience, and effectively supports PT Pertamina Hulu Rokan's digital office management needs, confirming its readiness for real-world implementation.

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III. RESULTS AND DISCUSSION

The results of this study demonstrate the successful development of a Office Application for PT Pertamina Hulu Rokan, integrating several modern technologies including Firebase, the Google Calendar API, and an AI-powered Chatbot. This integration provides a unified and intelligent system capable of streamlining office management processes—specifically in scheduling, activity coordination, and employee data management—while enhancing internal communication efficiency within the organization [1][8][9].

From a functional standpoint, the system meets its primary objectives by offering a cross-platform mobile solution that enables seamless accessibility for employees on both Android and iOS devices. The use of Flutter's framework ensures efficient cross-platform deployment, reducing development complexity and maintenance effort compared to native mobile applications [16][17]. The Firebase backend provides secure authentication, reliable data storage, and real-time synchronization, addressing one of the main limitations in traditional office management systems—data fragmentation and inconsistent accessibility [3][4][15]. Furthermore, the integration of the Google Calendar API allows automatic synchronization of meeting schedules and activities, minimizing overlapping events and improving organizational time management [8][9].

The inclusion of an AI-powered Chatbot introduces an intelligent interaction layer within the system, enabling employees to access information and receive automated assistance instantly. This not only improves communication efficiency but also reduces dependency on manual administrative processes [10]. In contrast to previous studies that relied solely on static or form-based data retrieval systems, this implementation demonstrates how conversational AI can effectively support real-time information access and decision-making in a corporate setting [19][20].

The developed application consists of multiple core components, each serving a specific functional role. These include a Splash Screen and Welcome Page as the system's entry point, Login and Password Recovery Pages that implement secure Firebase-based authentication, and a Dashboard Page that acts as a centralized hub for system navigation. Additional features include a Calendar Page for event scheduling and meeting management, a Chatbot Page for AI-assisted communication, an Activity Page for monitoring employee tasks, and a Profile Page for structured employee data management. All components adhere to Material Design principles, resulting in a clean, professional, and consistent user interface that enhances usability and supports a positive user experience [7][16].

Testing and validation were conducted under both normal and abnormal operating conditions to evaluate the system's reliability, stability, and performance. Functional tests confirmed that each module performed according to the defined requirements, while non-functional tests verified security, responsiveness, and data synchronization performance. For instance, login validation correctly restricted unauthorized access, while calendar synchronization effectively updated schedules in real time. Under simulated network interruptions, the system demonstrated fault tolerance by maintaining local data consistency until connectivity was restored [15]. These results validate the robustness of the developed system and its suitability for real-world deployment within a large organizational environment [18].

From a scientific standpoint, the integration of AI communication, cloud-based synchronization, and mobile cross-platform development represents a novel contribution to the digital transformation of office management systems. Compared with existing studies that focused on web-based or single-function administrative tools, this research presents a holistic and adaptive model for modern office automation. The use of the Agile methodology further supported iterative refinement and continuous feedback integration, ensuring that the final product aligns closely with user needs and operational requirements [12][13].

Overall, the findings confirm that the Flutter-Based Office Application effectively improves administrative efficiency, reduces redundancy, and enhances coordination within PT Pertamina Hulu Rokan. Scientifically, this study advances the concept of smart office systems by validating that the combination of AI-driven interaction, real-time synchronization, and cross-platform accessibility can significantly enhance operational agility and user engagement. These outcomes align with global trends in digital transformation and can serve as a practical model for other large-scale organizations seeking to modernize their administrative ecosystems [18][19].

A. Splash Screen and Welcome Page

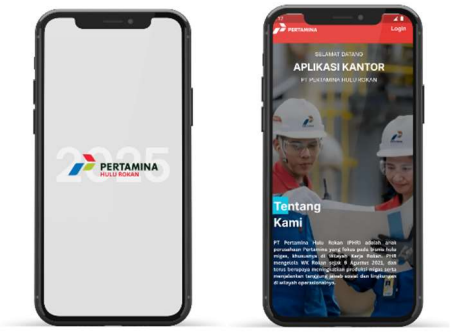

Figure. 5 Splash Screen and Welcome Page

Figure 5 presents the Splash Screen and Welcome Page of the Office Application developed for PT Pertamina Hulu Rokan, which serve as the user's first point of interaction with the system. The Splash Screen (Figure 4A) features a minimalist light gray background and prominently displays the Pertamina Hulu Rokan logo at the center, creating a clean and professional visual identity consistent with the company's branding. A semi-transparent white "2025" text appears in the background, symbolizing innovation and marking the application as part of the company's 2025 digital transformation initiative. This interface functions as a transitional screen during system initialization and automatically directs users to the Welcome Page once the application has fully loaded.

The Welcome Page introduces the system with a cohesive and informative design. It features the Pertamina logo at the top and a red "Login" button positioned for easy

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access. The central section displays the text "SELAMAT DATANG APLIKASI KANTOR PT PERTAMINA HULU ROKAN", clearly identifying the system as the company's official internal office application. The background showcases an image of Pertamina Hulu Rokan employees, reflecting professionalism and corporate identity, while the bottom section contains an "About Us" panel that briefly describes the company's role in the upstream oil and gas industry. Together, these interfaces visually communicate the company's modern and professional image, enhance user familiarity, and demonstrate how thoughtful UI/UX design contributes to an engaging and functional digital office management experience.

B. Login Page and Forget Password Page

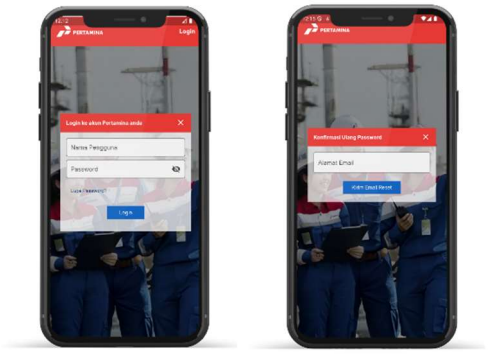

Figure 6. Login and Forget Password Page

Figure 6 illustrates the Login Page and Forgot Password Page of the Office Application developed for PT Pertamina Hulu Rokan, which function as the system's primary access and account recovery interfaces. The Login Page serves as the main entry point for registered users, requiring the input of a valid email and password verified through Firebase Authentication. Access is granted only when the provided credentials match the records stored in the system's secure backend. The interface features a simple and professional design dominated by Pertamina's signature red color, emphasizing both brand identity and clarity. Additional usability features include a password visibility toggle and a "Forgot Password?" link, ensuring convenient access while maintaining high security standards for corporate users.

The Forgot Password Page provides an account recovery solution for users who cannot log in due to forgotten credentials. In this interface, users enter their registered email address and press the "Send Reset Email" button to initiate a password reset process. Once submitted, the system integrated with Firebase Authentication automatically sends a secure reset link to the corresponding email, allowing the user to create a new password and regain account access. This feature not only streamlines the recovery process but also reinforces data privacy and account protection, as only verified email owners can reset their credentials. Together, these two pages demonstrate how security, accessibility, and brand coherence are integrated into the application's UI/UX design, ensuring safe and user-friendly authentication for all Pertamina Hulu Rokan employees.

C. Dashboard and Profile Page

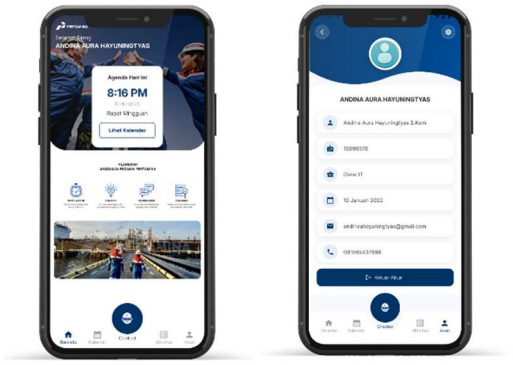

Figure 7. Dashboard and Profile Page

Figure 7 illustrates the Dashboard Page and Profile Page of the Office Application developed for PT Pertamina Hulu Rokan, which serve as the central components of user interaction and employee information management. The Dashboard Page functions as the main control center where employees can efficiently monitor their daily activities. At the top of the page, users are greeted with a personalized welcome message that dynamically adjusts to the time of day and displays the employee's name retrieved from Firebase Authentication. Below the greeting section, the dashboard presents the upcoming activity agenda complete with date and time information, along with a "View Calendar" button that provides direct navigation to the calendar page for detailed schedule management. The interface also features a visual section promoting the company's core values Punctuality, Efficiency, Communication, and Evaluation reinforcing Pertamina Hulu Rokan's professional culture. Complemented by an illustration of company workers, the dashboard design visually reflects the organization's identity as a major oil and gas operator. A bottom navigation bar provides quick access to the Calendar, Activity, Chatbot, and Profile pages, with the Chatbot icon prominently centered as a quick-access feature for AI-assisted help related to tasks and company information.

The Profile Page presents detailed and well-structured employee information through a modern, user-friendly interface. At the top of the page, an animated header displays the employee's profile picture and full name, followed by a series of turquoise data fields showing key information such as employee ID, division, joining date, email, and phone number. Each information field is accompanied by a distinct dark-blue icon, improving readability and visual organization. At the bottom of the page, a "Logout" button allows users to securely sign out of the system, automatically returning them to the Welcome Page. This feature helps maintain account security while ensuring easy access to essential employee data. The page also retains consistent bottom navigation with links to the Home, Calendar, Chatbot, and Activity pages, supporting smooth movement throughout the application. Overall, the Dashboard and Profile Pages combine functionality, visual

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coherence, and intuitive navigation, enabling employees to manage their work activities effectively while maintaining seamless access to their professional information within a secure and well-designed digital environment.

D. Calendar Page

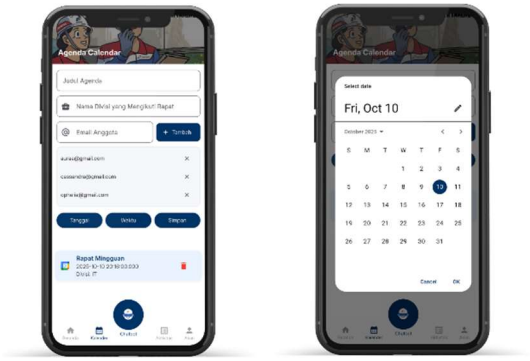

Figure 8. Calendar Page

Figure 8 illustrates the Calendar Page of the Application developed for PT Pertamina Hulu Rokan, which serves as a centralized feature for managing employee schedules through seamless integration with the Google Calendar API. This page allows users to efficiently create, view, and manage their work-related activities in real time. To add a new agenda, users can input the event title, select the date and time using the provided fields, and then press the "Add" button to save the schedule. Once submitted, the event is automatically synchronized with the company's Google Calendar account, ensuring that all scheduling data is securely stored in the cloud-based system and accessible across multiple devices.

In addition to event creation, the page displays a list of existing activities retrieved from Google Calendar, complete with time and date details for each scheduled event. Each listed agenda item includes a delete icon, enabling users to remove events directly through the interface while maintaining synchronization with Google Calendar. This integration provides employees with enhanced flexibility and accessibility in organizing, monitoring, and updating their office activities. By centralizing all scheduling functions in one interface, the Calendar Page not only streamlines task management but also exemplifies how real-time data synchronization and cross-platform integration can significantly improve workflow efficiency and coordination within a modern corporate environment.

E. Chatbot and Activity Page

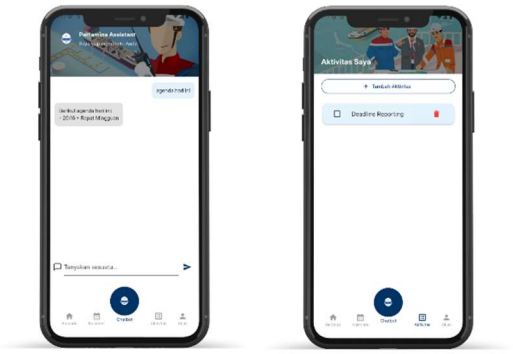

Figure 9. Chatbot and Activity Page

Figure 9 presents the Chatbot Page and Activity Page of the Office Application developed for PT Pertamina Hulu Rokan, which together enhance communication efficiency and daily task management for employees. The Chatbot Page, branded as Pertamina Assistant, introduces an AI-driven virtual assistant integrated with the OpenAI API. Through this interface, users can type various queries related to schedules, activities, or general office information, and receive instant, relevant responses generated by the embedded GPT-based language model. The interface adopts a professional yet minimalist design, featuring a header displaying the Pertamina Assistant logo and the status message "I am ready to assist you". Below the chat area, a text input field allows users to enter their questions, accompanied by a send button positioned on the right side. This integration enables real-time automated responses without the need for manual administrative assistance, significantly improving communication flow and employee productivity.

The Activity Page provides employees with an intuitive tool to record, organize, and monitor their daily work activities. The top section displays a header titled "My Activities", accompanied by an illustration reflecting Pertamina's professional workplace culture. A "Add Activity" button allows users to input new tasks easily using a simple form, while existing activities are listed below in light blue boxes. Each task entry includes a checkbox to mark completion status and a red delete icon for removing unnecessary items. This page serves as a personalized task management system, helping employees structure their work routines and maintain daily productivity. Consistent navigation buttons remain available at the bottom of the interface, providing seamless access to the Home, Calendar, Chatbot, and Profile pages. Overall, these two pages exemplify how AI-powered communication and structured activity management contribute to building a more efficient, connected, and user-friendly digital workplace for PT Pertamina Hulu Rokan.

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IV. CONCLUSION

This study successfully achieved its primary objective of developing an integrated Flutter-Based Office Application for PT Pertamina Hulu Rokan, which consolidates scheduling, communication, and employee management into a unified and intelligent digital platform [12]. The system effectively addresses the inefficiencies of conventional office management practices by leveraging cross-platform mobile development, AI-powered automation, and cloud-based synchronization to enhance operational efficiency, organizational collaboration, and administrative accuracy. By integrating Google Calendar, Firebase, and AI Chatbot technologies, the proposed application demonstrates how modern digital tools can work synergistically to create a responsive, reliable, and secure environment for managing complex corporate workflows.

From a scientific perspective, this research contributes to the field of smart office and enterprise information systems by providing a practical implementation model that bridges the disciplines of mobile computing, artificial intelligence, and real-time data integration. The study advances current understanding of how Flutter's cross-platform framework can serve as a foundation for scalable enterprise solutions, especially in large organizations requiring flexibility, rapid deployment, and consistent performance across devices. Furthermore, this research validates that AI-driven user interaction and cloud synchronization can minimize data fragmentation, reduce communication barriers, and establish a more efficient administrative ecosystem — outcomes that are directly aligned with global trends in Industry 4.0 digital transformation.

Practically, the application not only supports PT Pertamina Hulu Rokan's operational modernization but also provides a replicable and adaptable framework for other organizations aiming to implement similar smart office ecosystems. The system's modular architecture and integration capabilities make it suitable for expansion and customization according to different institutional needs, demonstrating its long-term scalability and sustainability.

Future work should focus on enhancing the AI Chatbot's natural language processing (NLP) capabilities to enable more contextual and human-like conversations, improving data protection mechanisms through the implementation of multi-factor authentication (MFA) and advanced encryption, and expanding interoperability with other enterprise systems such as HR management tools, document automation platforms, and project tracking systems [15][18]. In addition, longitudinal research evaluating the application's usability, scalability, and real-world performance within a large corporate environment is recommended to further validate its effectiveness and ensure continuous improvement.

In conclusion, the Office Application for PT Pertamina Hulu Rokan represents a significant advancement in digital office management. It not only provides a technologically robust and user-centered solution but also contributes academically by offering a scientific foundation and practical model for the implementation of integrated smart office systems that align with the evolving demands of the Industry 4.0 era [19][20].

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