OPEN ACCESS
VOL. 08, NO. 2, PP. 12–23, MAY 2026

ISSN : 2622-8106 (ONLINE)
DOI: 10.20895/INISTA.V8I2.2050

Journal of Informatics, Information System, Software Engineering and Applications (INISTA)

Development of a Meeting Room Reservation System in the Food and Beverage Industry

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Received: Month 09, 2025; Revised: Month 04, 2026; Accepted: Month 05, 2026.

Abstract

The manual process of meeting room reservations often takes considerable time and creates inefficiency, especially when coordinating schedules among multiple users. In addition, searching for meeting-related information is not yet integrated, and the absence of automatic reminders often causes users to miss scheduled meetings. To address these issues, a web-based system was developed to manage meeting room reservations digitally. The system includes an information search feature using a chatbot and automatic reminders integrated with Google Calendar or Outlook. The prototype method was applied in the development process. To ensure the system meets user needs, evaluations were carried out through functional testing, the User Experience Questionnaire (UEQ), and time efficiency testing. The functional testing results show that the system works properly and meets user requirements. Meanwhile, UEQ results indicate that all aspects, Attractiveness, Perspicuity, Efficiency, Dependability, and Stimulation, achieved the "Excellent" category. The highest score was for Stimulation at 2.531, suggesting the system provides an enjoyable, non-monotonous experience that fosters user engagement. In terms of efficiency, manual reservations required between 1,245 and 1,560 seconds, depending on the responsiveness of the admin or receptionist. After system implementation, booking time was reduced to 35 – 50 seconds. This shows an improvement in reservation efficiency of about 96%.

Keywords: *Chatbot, Meeting Room Reservation System, User Experience Questionnaire (UEQ)*

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I. INTRODUCTION

The food and beverage (F&B) industry in Indonesia has experienced significant growth in recent years. According to data from the Ministry of Industry (2024), this sector accounts for 40.33% of the non-oil and

gas industry's Gross Domestic Product (GDP) [1]. Along with this growth, the need for effective coordination between departments has become increasingly important as the key to the company's operational success. Meetings have become one of the main media to support problem-solving, decision-making, and information exchange between work units. However, the process of reserving meeting rooms at food and beverage companies in this study is still done manually, namely by contacting the plant administrator to make a reservation.

This manual process often causes a number of problems, including irregular meeting schedules and a lack of information about meeting room availability and capacity. In addition to hampering operational efficiency, this can also reduce company productivity. In fact, in the digital age, integrated information systems are essential to support collaborative and efficient work processes [2].

In addition to the main issues above, there are other problems that arise with manual meeting room reservations. First, schedule conflicts often occur, especially when several parties book meeting rooms at the same time. Research [3] shows that reservation systems that still use manual methods can lead to errors in recording, paper waste, and data loss due to missing or disorganized records. The second problem, namely participant absenteeism due to a lack of reminders, is also a common issue. When carrying out daily activities, people often find it difficult to organize their activities and frequently forget about scheduled activities they have planned [4]. Considering the busy schedule of activities, participants frequently miss important agendas due to the lack of adequate notifications.

Therefore, the development of a computerized meeting room reservation system becomes a strategic solution to address these challenges. This system is expected not only to serve as a platform for recording activities but also to provide up-to-date information on room availability and upcoming meeting schedules, enabling employees to access information quickly and accurately. With the integration of this system, potential schedule conflicts are expected to be minimized, and room reservations can be carried out transparently and systematically.

In addition to the meeting room recording and reservation features, the system is also equipped with a notification or reminder feature integrated with Google Calendar or Outlook, which automatically reminds participants of upcoming scheduled activities. A reminder is a highlighted message that helps individuals remember something, commonly found on mobile phones or other recording media [5]. The system also provides a chatbot feature that facilitates users in searching for information related to meeting schedules, available meeting rooms, and simplifies the process of booking a meeting room. A chatbot is a program capable of communicating with humans through text or voice messages. By utilizing Natural Language Processing (NLP), which is a part of artificial intelligence, users can interact with the computer using everyday language as if conversing with a human [6].

This study aims to develop an information system for meeting room reservations in a food and beverage production company. The system is expected to provide an effective solution to the scheduling issues that have been encountered. It not only serves as a tool for employees to manage their schedules but also supports the company's efforts to improve productivity and the effectiveness of operational activities. Through this reservation solution, the management of activities within the food and beverage production company is expected to become more structured and well-coordinated, thereby supporting the company's long-term goals of optimizing resource and time management.

II. RESEARCH METHOD

To produce a system that meets user needs, it is necessary to employ an appropriate research methodology in both data collection and system development. In this study, the researcher applies two main approaches: a data collection method to identify user requirements and a system development method to build the web-based system. This methodology serves as the foundation for developing a meeting room reservation system that enhances efficiency and provides an optimal user experience.

A. Data Collection Method

In this study, the data collection method used is interviews. The interviews were conducted directly within the company environment under the guidance of Mrs. Aditya Permatasari, serving as the Plant Admin. The purpose of these interviews was to gain a comprehensive understanding of the ongoing business processes, as well as to identify the functional and non-functional requirements necessary for the development of the meeting room reservation system.

B. Development Method

In the development of the proposed system, the prototype method was employed. The prototype method is one of the system development techniques that utilizes a simplified model of the system to be built, enabling developers to evaluate and optimize the system before its full implementation [7]. The prototype or prototyping model is a software development model that is used to make a prototype version of the software. The purpose of the prototyping method is to provide users with an overview of how the application will be developed by first creating a prototype system, allowing users to give feedback [8]. This model is used when the customer or user doesn't have any specific or detailed information about the product [9]. The stages of the prototype method involve creating an initial model of a system for testing and collecting feedback prior to developing the final version. This method is essential as it allows developers to identify shortcomings and make improvements before the system is fully deployed. By using prototypes, system development becomes more efficient and produces better solutions [10]. The prototype method consists of five processes: communication, quick plan, quick design, prototype construction, and delivery & feedback, as illustrated in Figure 1.

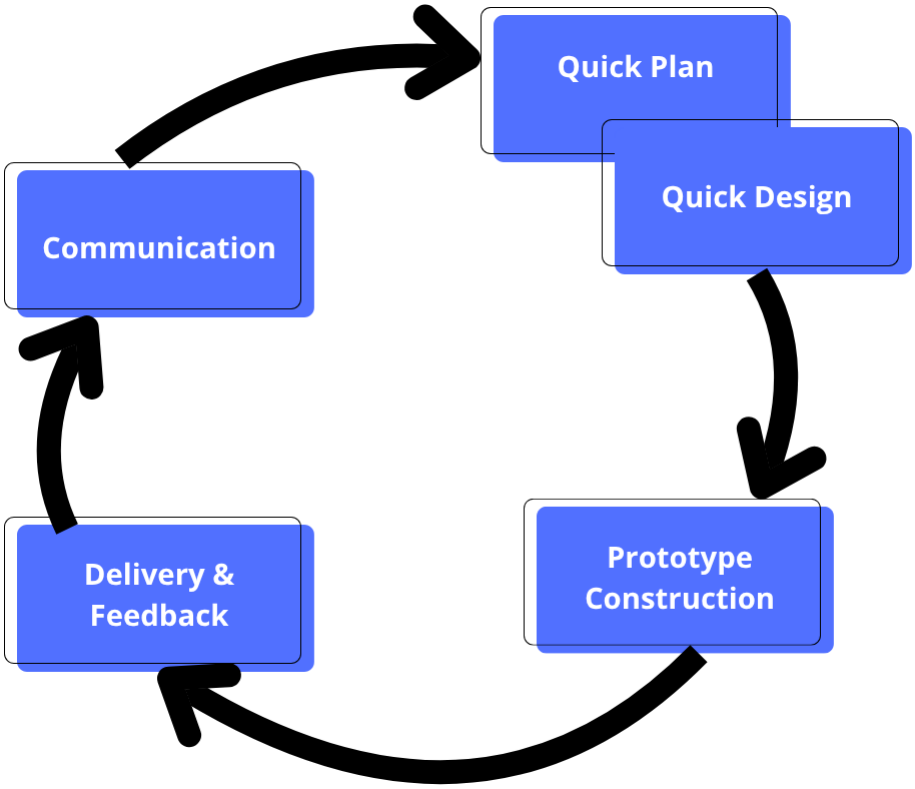


Fig. 1. Research Stages

1) Communication

At this stage, system requirements are gathered by listening to customer complaints. To develop a system that meets user needs, it is essential to first understand how the current system operates in order to identify the existing problems [11]. Interviews were conducted with Mrs. Aditya Permatasari, serving as the Plant Admin, to identify the problems that existed before the system and to determine the features required for the system to be developed. The outcome of this stage was an overview of the current business processes and the identification of system requirements.

2) Quick Plan

In the quick plan stage, the system designer conducts a brief planning phase based on user needs from the communication stage by creating an interface design and other supporting requirements required during this process [12]. This stage focuses on outlining the overall system structure, determining key features,

and identifying the resources and technologies required for development. It also serves to establish initial design concepts, prioritize functionalities, and ensure that the proposed solution aligns with user expectations. By doing so, the quick plan stage helps streamline the development process and provides a clear direction for subsequent design and implementation phases.

3) Quick Design

The second stage is Quick Plan. At this stage, the technologies to be used were determined, and the design of the user interface, along with simple mockups of one of the system features, was carried out. At this stage, the application design model is developed with an efficient design timeline to describe the client's requirements based on the analysis conducted previously. [13].

4) Prototype Construction

The third stage is Modeling Quick Design, in which the initial prototype design was created to illustrate the basic functionalities of the system. This design included a Use Case Diagram to describe the system's actors and activities, an Activity Diagram to represent process flows, and an Entity Relationship Diagram to visualize database relationships. In addition, user interface designs for each required feature were also developed based on the interview results. Construction of the prototype is the stage where developers begin creating a prototype based on the previous design. The developed prototype can be either a simple visual model of the software or a coded system that includes some of the required system functions [14].

5) Deployment, Delivery & Feedback

The evaluation and feedback phase is a critical stage that determines whether the prototype will proceed to the product engineering phase or the system development phase. This phase assesses whether modifications to the previously defined software requirements are necessary [15]. In this stage, the developed prototype was tested by users for evaluation and feedback. The feedback obtained became the basis for improvements and refinements to the prototype, both in terms of the user interface and system features.

C. Flowise AI

Flowise is an open-source platform that enables developers and users to create chatbots or applications based on Large Language Models (LLMs) visually and interactively [16]. Flowise AI provides a framework for building question-and-answer systems that retrieve information accurately. Low-code AI systems such as Flowise AI, which employ Retrieval-Augmented Generation (RAG), have been used to enhance information retrieval in healthcare, supporting more accurate and timely clinical decision-making [17]. Flowise AI functions as a visual interface that allows users to create conversational flows, configure responses, and connect various nodes (modules) easily, enabling the development of more advanced and functional chatbot solutions [18].

D. Black Box Testing

Black box testing is a testing method that evaluates the functionality of software without considering the internal structure or code implementation. It is often referred to as functional testing. In this method, testers only interact with the user interface and verify the output produced based on specific inputs according to the software requirements specification [19]. A study conducted by [20] states that Black Box testing is commonly used because it evaluates system functionality without requiring testers to understand the internal code structure or specific programming languages.

E. User Experience Questionnaire

The User Experience Questionnaire is used to find out respondents' responses to the system that has been built, which is generally used in research in the form of surveys and questions given to respondents [21]. In the research conducted by [22], the reason for using UEQ testing was to measure how comfortable and satisfied a person is with a product, system, and service based on the appearance, accessibility, and performance of the interface. UEQ is suitable for testing the usability of systems in the form of questionnaires that can provide quick assessments [23].

F. Time Efficiency Testing

Time efficiency testing is a method used to measure the amount of time required to complete a process or task using a system. This testing aims to evaluate the system's speed and data-processing performance, as

well as compare the efficiency of the existing and newly developed systems. The less time required, the more efficient the system is considered to be. Efficiency is divided into two types: time efficiency and cost efficiency. Time efficiency is the level of time economy from the start of implementation to project completion [24]. This testing is conducted to compare time efficiency before and after the implementation of the system or application. It aims to measure how much improvement the system provides in reducing the time required to complete specific tasks or processes. By analyzing the results, it can be determined whether the developed system effectively enhances operational efficiency and optimizes overall performance compared to the previous manual or existing method.

III. RESULT AND DISCUSSION

A. Use Case Diagram

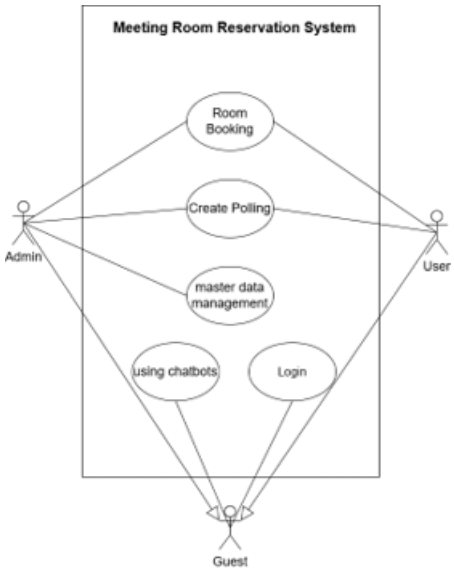


Fig. 2. Use Case Diagram

Figure 2 illustrates the Use Case Diagram of the system to be developed. There are three roles in the system: Admin, User, and Guest. The Admin role has full access to all features within the system, while the User role can access all features except those related to managing master data.

B. Activity Diagram

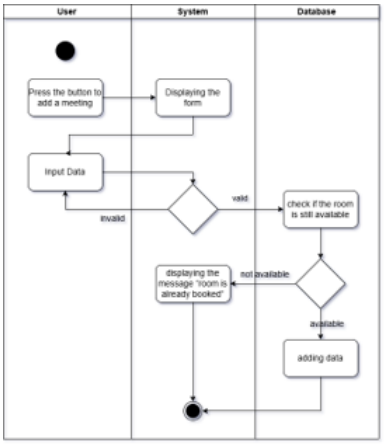


Fig. 3. Room Booking Activity Diagram

Figure 3 illustrates the activity diagram for the room booking feature. The developed room booking system allows users to reserve meeting rooms online through a structured process. The process begins when the user clicks the Add Meeting button, after which the system displays a booking form to be completed. Once the data is entered, the system performs validation to ensure the completeness and accuracy of the information. If invalid data is detected, the system provides an error message indicating the problematic input. If the data is valid, the system checks room availability in the database. If the room is already booked, the system displays a notification indicating that the room is unavailable. Conversely, if the room is available, the system automatically adds the reservation data to the database and provides a confirmation of successful booking to the user.

C. Chatbot Chatflow

The chatbot was implemented using the open-source platform Flowise AI.

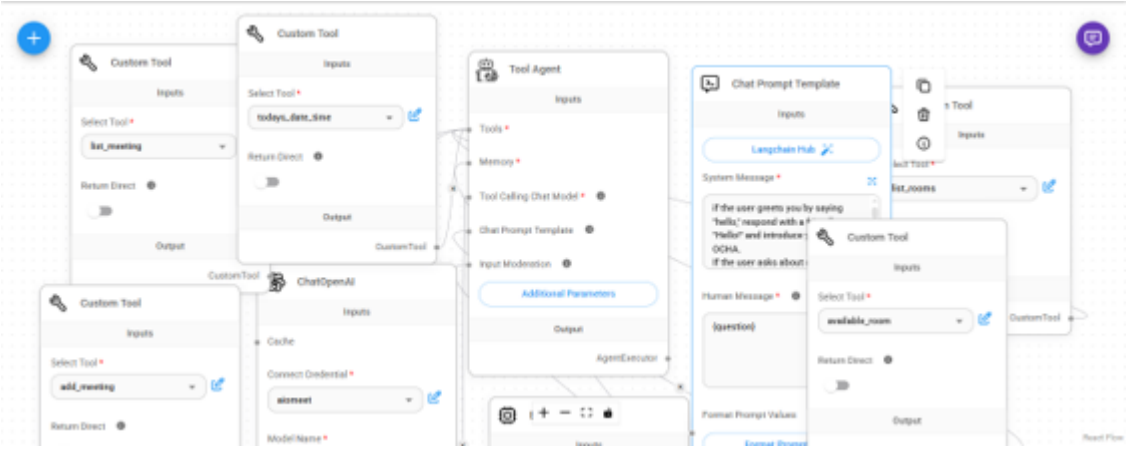


Fig. 4. Chatbot Chatflow

Figure 4 illustrates the chat flow of the chatbot feature. The model used in this flow is from OpenAI. In addition, the chatflow also employs custom tools that provide additional features not available by default and are tailored to the system's needs. Each custom tool is connected to an API to retrieve information based on its description. The responses from these custom tools are then processed by the chatbot model and presented to the user.

D. Implementation and Testing

The meeting room reservation system was developed to make it easier for employees at food and beverage manufacturing companies to book meeting rooms and obtain information about schedules and room availability. This system can be used by all factory employees. Figures 6 to 7 show some of the features of the implemented system.

Figure 5 shows the room booking form, which contains mandatory fields such as meeting name, date, start and end times, meeting type, location, room selection for offline/hybrid meetings, and meeting links for online/hybrid meetings. In addition, there are fields for the organizer and participants. Optional fields include the number of accessories, attachments, and description. There is also a send email directly button to send meeting schedule notifications via email to the organizer and participants.

Figure 6 shows the chatbot interface, which is equipped with three shortcut buttons to make it easier for users to ask questions. The chatbot feature can be used to ask for meeting information, such as a list of meetings held on a certain day, either today or on a date specified by the user. In addition, the chatbot can also be used to create meeting schedules or reserve meeting rooms.

Figure 7 shows the poll creation form interface. This form has several fields, namely poll title, poll description, poll creator, list of dates and times for the poll, and poll participants. Users can use this feature to create polls for participants to determine the schedule for meetings to be held.

After the system has been implemented, the next step is to test its features to ensure that it is running according to requirements. This system testing uses the Blackbox Testing method, which is a testing method

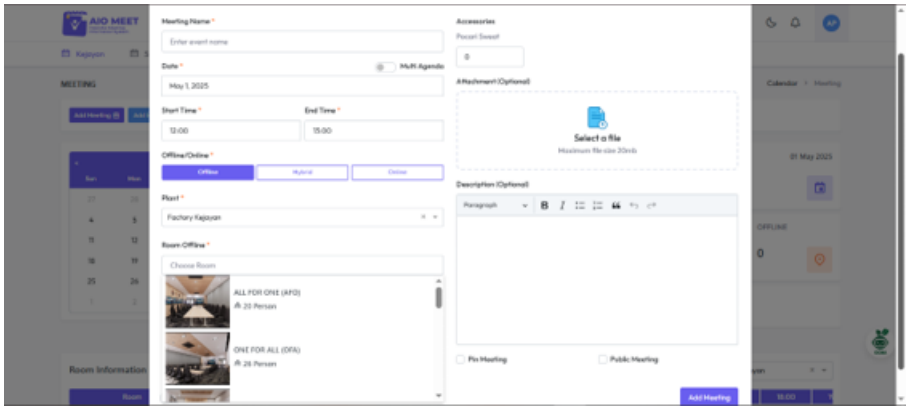


Fig. 5. Room Booking Form Interface

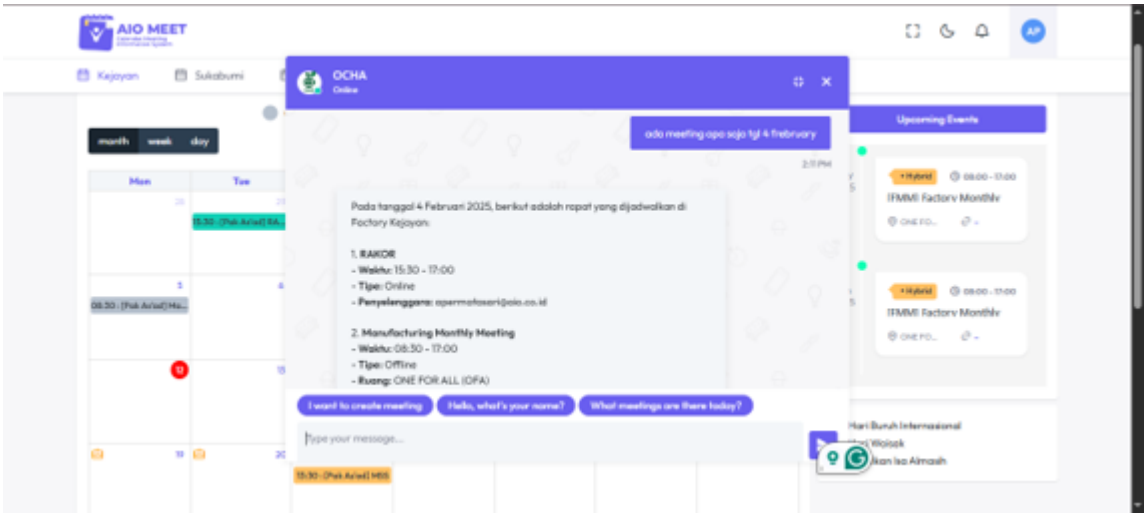


Fig. 6. Chatbot Interface

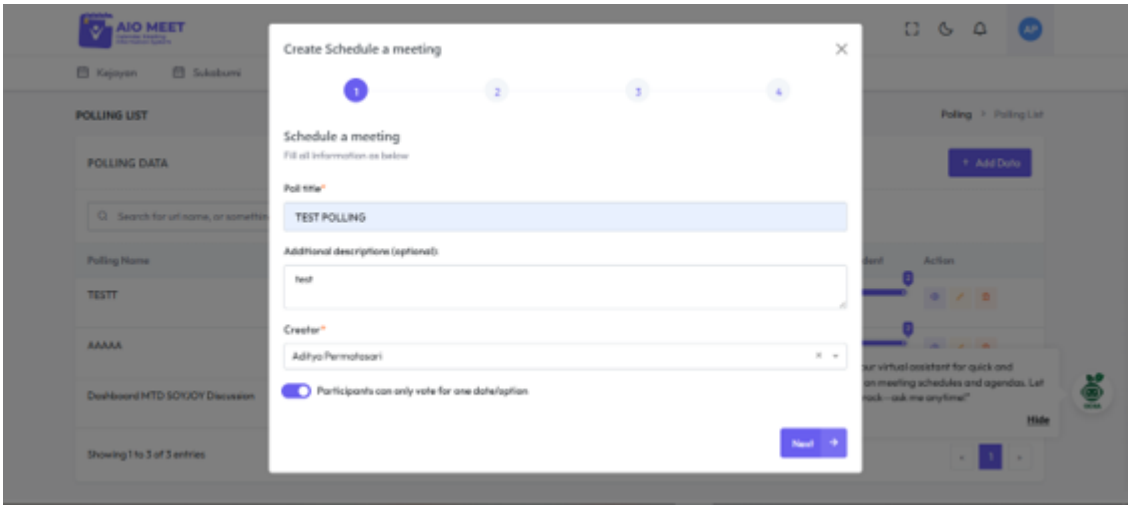


Fig. 7. Form Create Polling Interface

that focuses on software functional specifications. In this method, the tester defines a set of input conditions and tests the functional specifications of the program [1]. This testing is carried out in two iterations.

TABLE I. BLACK BOX TESTING SCENARIO

Testing Scenario	What to Expect	Result
The user enters a valid username and password.	User successfully logged in	Valid
Users fill in the fields on the room reservation form with valid information and submit it.	Data successfully saved	Valid
Users create a meeting schedule poll with several time options.	The poll has been successfully created and is accessible to participants.	Valid
Participants select the available time options and submit their answers.	Poll answers are saved and counted in the poll results	Valid
Users send questions via chatbot regarding meeting information or meeting rooms.	The chatbot responds according to the context of the question and provides informative answers.	Valid
Adding, changing, or deleting master data	Changes to stored data	Valid

Based on black box testing in the first iteration, all main functions in the system ran well according to the designed scenario. However, an error was found in one of the chatbot features used to ask for information related to meeting schedules. The error occurred when users asked for today's meeting schedule, where the system did not retrieve the current date correctly.

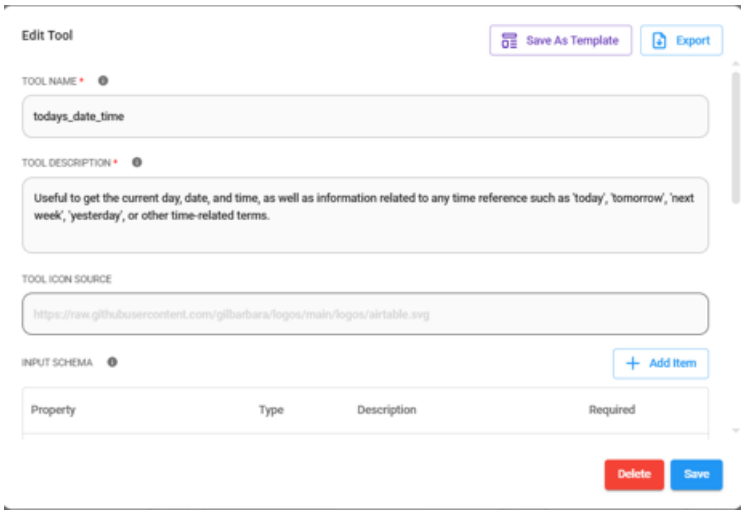
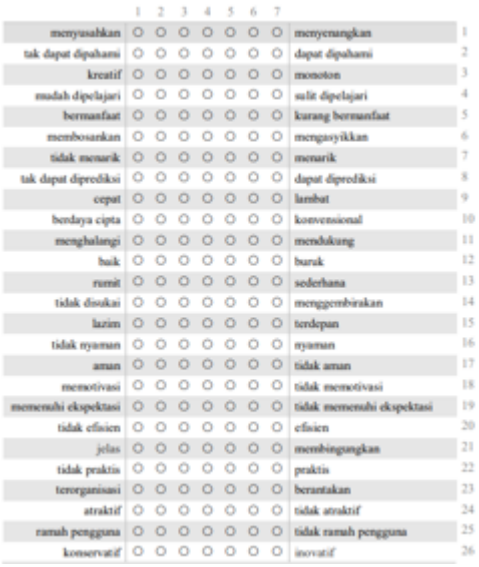


Fig. 8. Custom Tool

Figure 8 shows an additional custom tool used to retrieve the current date. When the flow is executed, this tool will directly access the system time and return it in a specified date format, such as YYYY-MM-DD. This date value can then be used by other nodes in the flow, for example, to record the time when the process is running. After the bug was fixed, the chatbot feature was tested again. The results showed that all scenarios in the black box testing were validated.

In addition to testing the functionality of the system, in this study, the researchers also used the User Experience Questionnaire (UEQ). The UEQ consists of 26 items grouped into 6 scales (Attractiveness, Perspective, Efficiency, Dependability, Stimulation, and Novelty). Each scale represents a different aspect of UX quality.



	1	2	3	4	5	6	7		
menyusahkan	O	O	O	O	O	O	O	menyenangkan	1
tak dapat dipahami	O	O	O	O	O	O	O	dapat dipahami	2
kreatif	O	O	O	O	O	O	O	monoton	3
mudah dipelajari	O	O	O	O	O	O	O	sulit dipelajari	4
bermanfaat	O	O	O	O	O	O	O	kurang bermanfaat	5
membosankan	O	O	O	O	O	O	O	mengasyikkan	6
tidak menarik	O	O	O	O	O	O	O	menarik	7
tak dapat diprediksi	O	O	O	O	O	O	O	dapat diprediksi	8
cepat	O	O	O	O	O	O	O	lambat	9
berdaya cipta	O	O	O	O	O	O	O	konvensional	10
menghalangi	O	O	O	O	O	O	O	mendukung	11
baik	O	O	O	O	O	O	O	buruk	12
rumit	O	O	O	O	O	O	O	sederhana	13
tidak disukai	O	O	O	O	O	O	O	menggembirakan	14
lazim	O	O	O	O	O	O	O	terdepan	15
tidak nyaman	O	O	O	O	O	O	O	nyaman	16
aman	O	O	O	O	O	O	O	tidak aman	17
memotivasi	O	O	O	O	O	O	O	tidak memotivasi	18
memenuhi ekspektasi	O	O	O	O	O	O	O	tidak memenuhi ekspektasi	19
tidak efisien	O	O	O	O	O	O	O	efisien	20
jelas	O	O	O	O	O	O	O	membingungkan	21
tidak praktis	O	O	O	O	O	O	O	praktis	22
terorganisasi	O	O	O	O	O	O	O	berantakan	23
atraktif	O	O	O	O	O	O	O	tidak atraktif	24
ramah pengguna	O	O	O	O	O	O	O	tidak ramah pengguna	25
konservatif	O	O	O	O	O	O	O	inovatif	26

Fig. 9. UEQ Question

Figure 9 shows 26 UEQ questions with a 7-point rating scale (1–7) grouped into six assessment aspects. These questions will be implemented in the form of a Google Form, then distributed to several application users. The assessment results obtained will be analyzed using data analysis tools to measure the quality of the user experience based on each aspect tested.

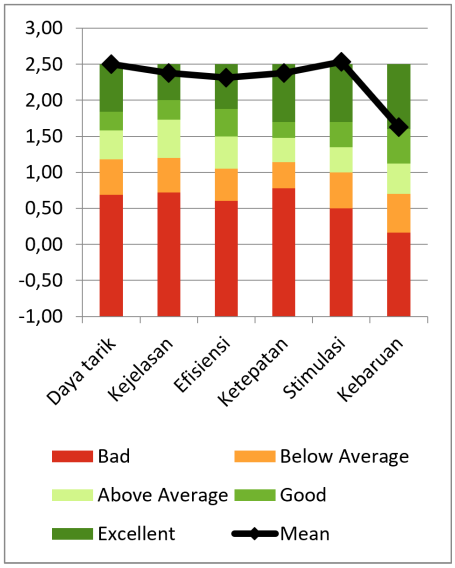


Fig. 10. UEQ Result Benchmark

Based on the calculations and analysis shown in Figure 10, all aspects received scores in the Excellent category, with Stimulation receiving the highest score among the other aspects. This shows that users felt very emotionally motivated and interested in the appearance and interaction of the tested system.

In addition, this study conducted time efficiency testing to determine the extent of the impact before the system was developed and after it was developed and used. The increase in time efficiency in the meeting room reservation process after the system was implemented was proven through testing in Table 2 and Table 3.

Table 2 shows the results of testing the efficiency of manual reservations. The total time may vary depending on the response from the administrator or receptionist.

TABLE II. MANUAL EFFICIENCY TESTING

No	Testing Description	Time (seconds)
1	Ask the plant administrator or receptionist about room availability.	480 - 600
2	The plant administrator or receptionist manually checks which rooms are still available and responds to the employee who wants to reserve a room.	45 - 60
3	The employee fills out the room reservation form and confirms with the plant administrator or receptionist.	480 - 600
4	The plant administrator or receptionist records the reservation and confirms it with the employee who reserved the room.	240 - 300
	Total Time (seconds)	1245 - 1560

TABLE III. EFFICIENCY TESTING USING SYSTEMS.

No	Testing Description	Time (seconds)
1.	Log in to the system and check room availability	15 - 20
2.	Filling in the room reservation data and submitting data	20 - 30
	Total Time (seconds)	35 - 50

Table 3 shows the results of testing the time efficiency of meeting room reservations using the system. The manual reservation process required between 1,245 and 1,560 seconds, depending on the responsiveness of the admin or receptionist. After implementing the system, the reservation time was significantly reduced to approximately 35 to 50 seconds. Based on research conducted by [25], Equation 1 was used to calculate time efficiency. Based on the time efficiency calculation, there was a 96% increase in efficiency. This suggests that the meeting room reservation system can expedite the reservation process.

$$Efficiency(\%) = \left(\frac{Manual\ Time - System\ Time}{Manual\ Time}\right) \times 100\% \tag{1}$$

$$Time\ Efficiency = \left(\frac{1245 - 50}{1245}\right) \times 100\% = 96\%$$

IV. CONCLUSION

The developed system successfully simplified the meeting room booking process while also improving reservation time efficiency. Testing showed that the manual reservation process required between 1,245 and 1,560 seconds, depending on the responsiveness of the admin or receptionist. After the system was implemented, this time was drastically reduced to only 35 to 50 seconds, representing an efficiency improvement of approximately 96%. In addition, the chatbot feature proved to facilitate and accelerate the search for information related to meeting schedules and room availability. Before this feature, users had to contact the plant admin or receptionist and wait for a response, which was considered inefficient. The reminder feature integrated with Google Calendar also helped users remember meeting schedules, thereby minimizing the risk of forgetting to attend important meetings or events. Although the system has performed well, there is still room for further development. One suggestion for future enhancement is the addition of an automatic minutes-of-meeting recording feature supported by the chatbot, which would be capable of generating meeting summaries. This improvement would further increase the usefulness and functionality of the system.

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