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Development of AI Chatbot Using Gemini LLM for Student Registration Information Services

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ABSTRACT
The development of information technology has encouraged educational institutions to adopt digital innovations to improve administrative and information services. Pondok Pesantren As-Saidiyyah 2 still relies on manual communication methods for new student registration information services, resulting in delayed responses, inconsistent information delivery, and increased administrative workload. This study aims to develop an AI chatbot using the Gemini Large Language Model (LLM) to provide automated and contextual student registration information services. The system was developed using the Waterfall method, which includes requirement analysis, system design, implementation, testing, and maintenance stages. The chatbot was integrated into a web-based platform to assist prospective students and parents in obtaining registration information efficiently. System evaluation was conducted using Blackbox Testing and User Acceptance Testing (UAT). The testing results indicate that the chatbot functions properly and is capable of generating fast and contextual responses with an average response time of 1–3 seconds. Furthermore, the system achieved a UAT score of 79.73%, categorized as "Good", indicating positive user acceptance in terms of usability, response accuracy, and service efficiency. The implementation of Gemini LLM improved the effectiveness of information services and reduced repetitive administrative communication. This study demonstrates that LLM-based chatbot technology can support the digital transformation of information services in Islamic educational institutions.

***Keywords**: Artificial Intelligence; Chatbot; Gemini LLM; Customer Service; Student Registration.*

INTRODUCTION

The rapid development of information technology has encouraged educational institutions to adopt digital transformation in various administrative and academic services. The implementation of digital systems is considered capable of improving service efficiency, accelerating information dissemination, and enhancing communication quality between institutions and service users. One of the technologies currently experiencing significant development is Artificial Intelligence (AI), particularly conversational AI in the form of chatbots. AI-based chatbots have been widely implemented in customer service systems because they can provide automatic responses, reduce human workload, and improve service accessibility at any time.

In the educational sector, information services for new student registration are important in supporting effective communication between institutions, prospective students, and parents. However, many educational institutions, including Islamic boarding schools, still rely on conventional communication methods such as manual chat responses through messaging applications. This condition often causes delayed responses, inconsistent information delivery, repetitive administrative communication, and increased workload for administrators. Similar conditions also occur at Pondok Pesantren As-Saidiyyah 2, where student registration information services are still handled manually by administrative staff.

Several previous studies have implemented chatbots for educational information services using rule-based methods and keyword matching techniques. Although these approaches are capable of answering predefined questions, they still have limitations in understanding contextual conversations and generating flexible responses. Rule-based chatbots generally depend on manually structured response

patterns, making them less adaptive when users ask questions using different sentence structures or more natural conversational styles.

Recent developments in Large Language Model (LLM) technology provide new opportunities for developing more intelligent and contextual chatbot systems. Gemini LLM, developed by Google, is capable of understanding natural language context and generating more flexible responses compared to conventional chatbot approaches. The implementation of LLM technology enables chatbot systems to provide more natural interactions, improve response relevance, and support adaptive communication processes in information service systems.

Based on these problems and technological developments, this study aims to develop an AI chatbot using Gemini LLM for student registration information services at Pondok Pesantren As-Saidiyyah 2. The system is expected to improve service efficiency, reduce repetitive administrative communication, and provide fast and contextual information access for prospective students and parents. In addition, this research contributes to the implementation of LLM-based conversational AI technology in the digital transformation of Islamic educational institution services.

METHOD

This study employed the Waterfall software development method to develop an AI chatbot system for student registration information services. The Waterfall method was selected because it provides a systematic and structured development process through sequential stages, including requirement analysis, system design, implementation, testing, and maintenance. The requirement analysis stage was conducted by identifying problems and service needs in the student registration information process at Pondok Pesantren As-Saidiyyah 2. Data collection was performed through observation, interviews with administrative staff, and analysis of registration information frequently requested by prospective students and parents. The analysis results indicated that the existing manual information service caused repetitive communication, delayed responses, and inconsistent information delivery.

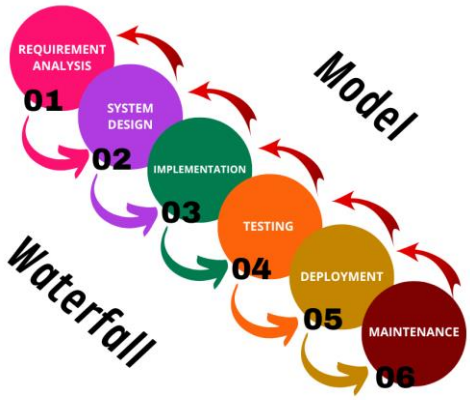

Figure 1. Waterfall Method

The system design stage included the design of chatbot architecture, database structure, user interface, and system workflow. The chatbot system was developed as a web-based application integrated with the Gemini Large Language Model (LLM) API to generate contextual responses automatically. The system architecture consists of users, web application interfaces, chatbot processing modules, databases, and Gemini AI services. Users submit questions through the chatbot interface, then the system processes the requests and forwards them to the Gemini API to generate relevant responses based on the provided prompts and registration information database. The implementation stage involved developing the system using web technologies and integrating the Gemini AI API into the chatbot service module. The chatbot was designed to provide information related to registration procedures, requirements, schedules, costs, facilities, and other administrative information automatically and continuously.

System testing was conducted using Blackbox Testing and User Acceptance Testing (UAT). Blackbox Testing was used to evaluate system functionality based on user interactions without examining the internal program code structure. Meanwhile, UAT was conducted to measure user satisfaction and acceptance levels regarding usability, response accuracy, interface design, and service efficiency. The

UAT assessment involved prospective users and administrative staff using a questionnaire-based evaluation method.

RESULT AND DISCUSSION

- **System Implementation**

The developed system is an AI chatbot designed to provide student registration information services at Pondok Pesantren As-Saidiyyah 2. The chatbot was implemented as a web-based application integrated with the Gemini Large Language Model (LLM) API to support automatic and contextual conversations between users and the system. The chatbot interface allows prospective students and parents to access registration information interactively through a chat interface. Users can ask questions related to registration requirements, registration schedules, tuition fees, dormitory facilities, administrative procedures, and other supporting information. The system processes user input and forwards requests to the Gemini API to generate relevant responses based on the provided prompts and information database. The implementation results indicate that the chatbot is capable of generating fast responses with an average response time of approximately 1–3 seconds depending on network conditions and request complexity. In addition, the use of Gemini LLM enables the chatbot to understand natural language input and provide more flexible responses compared to conventional rule-based chatbot systems.

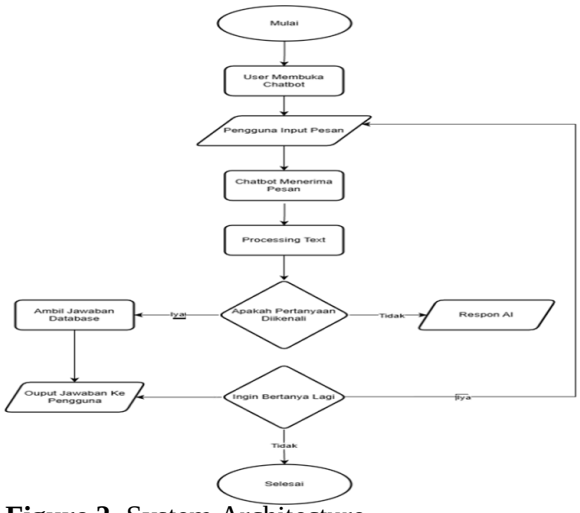

Figure 2. System Architecture

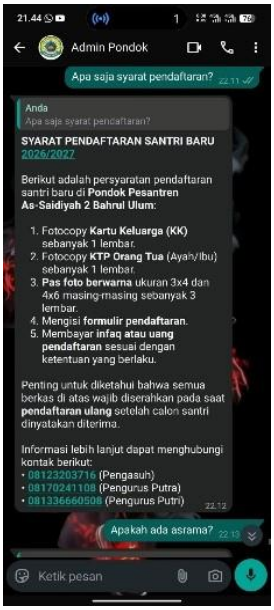

Figure 3. Chatbot Interface

- **Functional Testing Result**

Functional testing was conducted using the Blackbox Testing method to evaluate system functionality based on user interactions. The testing process focused on validating whether each feature operated according to the expected system requirements. Several tested features included user login, chatbot interaction, message processing, AI response generation, and information retrieval functions. The testing results showed that all system features operated successfully without significant functional errors. The chatbot was able to receive user questions, process requests properly, and generate appropriate responses through Gemini AI integration. In addition, the system interface functioned properly on web-based access environments, allowing users to interact with the chatbot smoothly.

Table 1. Blackbox Testing Result

No	Tested Feature	Expected Result	Actual Result	Status
1	Login System	User successfully logs into the system	System successfully logged in	Valid
2	Chatbot Input	System receives user messages	Message processed successfully	Valid
3	Gemini AI Response	Chatbot generates contextual response	Response displayed correctly	Valid
4	Registration Information	System provides registration information	Information displayed properly	Valid
5	Logout Feature	User exits the system successfully	Logout process successful	Valid

Table 1 shows the results of Blackbox Testing conducted on the chatbot system. The testing results indicate that all features operated properly according to the expected system requirements.

- **User Acceptance Testing Result**

User Acceptance Testing (UAT) was conducted to measure user satisfaction and system acceptance levels after implementation. The evaluation involved administrative staff and prospective users who interacted directly with the chatbot system. Assessment indicators included usability, response accuracy, interface appearance, ease of interaction, and service efficiency. Based on the UAT results, the system achieved a score of 79.73%, categorized as “Good”. The evaluation results indicate that users positively accepted the chatbot system and considered it capable of improving accessibility to student registration information services. Users also reported that the chatbot simplified the process of obtaining information without requiring direct communication with administrative staff.

Table 2. User Acceptance Testing Result

No	Assessment Aspect	Percentage
1	Ease of Use	82%
2	Interface Design	78%
3	Response Accuracy	81%
4	Service Efficiency	80%
5	User Satisfaction	77%
Average Score		79.73%

Table 2 and Figure 1 present the User Acceptance Testing (UAT) results. Based on the evaluation, the system achieved an average score of 79.73%, categorized as “Good”, indicating positive user acceptance toward the implemented chatbot system.

Discussion

The implementation of Gemini LLM in the chatbot system demonstrated significant improvements in the effectiveness of student registration information services at Pondok Pesantren As-Saidiyyah 2. Based on the testing results, the chatbot was capable of generating contextual and adaptive responses in real time, allowing users to obtain information more efficiently compared to conventional manual communication methods. The integration of conversational AI technology also improved service accessibility because users could access information at any time without depending on administrative staff availability.

The Blackbox Testing results indicated that all system features operated according to the expected functional requirements. The successful operation of login features, chatbot interactions, message processing, and AI response generation demonstrates that the system architecture and Gemini API integration were implemented properly. These results confirm that the developed chatbot system is functionally reliable for supporting registration information services. Furthermore, the User Acceptance Testing (UAT) result of 79.73% shows that users positively accepted the implemented system. This result indicates that the chatbot was considered easy to use, capable of providing relevant information, and effective in simplifying communication processes. The positive user response also reflects the growing acceptance of AI-based technologies in educational administrative services, particularly in Islamic educational institutions.

Compared to conventional rule-based chatbot systems used in previous studies, the implementation of Gemini LLM provides several advantages. Rule-based chatbots generally depend on predefined keywords and static response structures, making them less flexible in handling natural language variations. In contrast, Gemini LLM enables the chatbot to understand contextual conversations and generate more adaptive responses based on user intent. This capability improves interaction quality and reduces communication limitations commonly experienced in conventional chatbot implementations.

The implementation of AI chatbot technology also contributes to reducing repetitive administrative workloads. Before the system was implemented, administrative staff manually answered similar registration-related questions repeatedly through messaging applications. After integrating the chatbot system, information delivery became more automated and consistent, allowing administrative staff to focus on more complex service activities. This finding demonstrates that conversational AI can support operational efficiency and digital transformation in educational institutions. In addition, this study contributes to the implementation of Large Language Model technology in educational information service systems, particularly within Islamic boarding school environments. The research demonstrates that LLM-based conversational AI can be utilized not only for commercial customer service systems but also for improving public and educational service quality. Therefore, the developed system has the potential to be adopted and further developed in other educational institutions requiring efficient and intelligent information service systems.

Although the developed chatbot system showed positive results, this study still has several limitations. The chatbot responses depend on internet connectivity and external AI service availability. In addition, the system currently focuses only on student registration information services and has not yet integrated full online registration or multilingual communication features. Future research can focus on integrating more advanced administrative services, expanding conversational datasets, and improving response personalization capabilities.

CONCLUSIONS

This study successfully developed an AI chatbot using Gemini Large Language Model (LLM) technology for student registration information services at Pondok Pesantren As-Saidiyyah 2. The developed system was capable of providing automatic, fast, and contextual responses related to registration procedures, administrative requirements, tuition fees, schedules, and other supporting information. Based on the Blackbox Testing results, all system features operated properly according to the expected functional requirements. Furthermore, the User Acceptance Testing (UAT) result of 79.73% indicates that the chatbot system was positively accepted by users in terms of usability, response relevance, and service efficiency.

The implementation of Gemini LLM improved interaction quality compared to conventional rule-based chatbot systems by enabling more adaptive and natural communication processes. In addition, the chatbot system contributed to reducing repetitive administrative workloads and improving accessibility to registration information services. This study demonstrates that LLM-based conversational AI technology

has significant potential to support digital transformation in educational institutions, particularly in Islamic boarding school environments. Future research can focus on integrating the chatbot with full online registration systems, expanding multilingual communication capabilities, and improving response personalization through additional conversational datasets and training approaches.

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