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Academic Chatbot Based on Natural Language Processing for Student Services at STMIK Mulia Darma

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Abstract− The increasing demand for efficient and accessible academic services has led higher education institutions to adopt innovative digital solutions. At STMIK Mulia Darma, students often experience delays and limited access to academic information due to manual service systems and limited staff availability. To address these challenges, this research proposes the development of an academic chatbot using Natural Language Processing (NLP) to automate and enhance student services. The chatbot is designed to understand and respond to student inquiries in Bahasa Indonesia, providing real-time information related to course schedules, registration procedures, tuition deadlines, and other academic matters. By integrating NLP with the institution's academic information system, the chatbot delivers personalized and context-aware responses. The system was developed using a rule-based NLP model enhanced with intent classification and entity recognition techniques. Testing results indicate that the chatbot successfully answered more than 90% of user queries with acceptable response time and accuracy. This solution demonstrates the potential of NLP-powered chatbots to improve service efficiency, reduce administrative workload, and support the implementation of a smart campus ecosystem..

Keywords: Academic Chatbot; Natural Language Processing; Student Services; Higher Education; Smart Campus

1. INTRODUCTION

The rapid advancement of information technology has had a profound impact on various sectors, including education. Higher education institutions are increasingly required to adopt digital innovations to improve the quality of their academic services. Among these innovations, the use of chatbots—especially those powered by Natural Language Processing (NLP)—has become an effective solution for automating and enhancing student services. A chatbot is a computer program that simulates human conversation, either via text or voice, and NLP enables these systems to understand and process human language naturally and contextually [1].

At STMIK Mulia Darma, the majority of academic services are still conducted manually or through conventional communication platforms such as WhatsApp groups, email, or in-person inquiries. These methods often present several inefficiencies: response delays, information inconsistency, service unavailability outside working hours, and increased workload for administrative staff. As student numbers continue to grow, the demand for fast, accurate, and scalable academic services is rising, pushing the institution to seek alternative digital solutions.

An academic chatbot equipped with NLP capabilities has the potential to revolutionize how information is accessed by students. The system can provide 24/7 automated responses to frequently asked questions, including academic calendars, course registration procedures, tuition deadlines, graduation requirements, and many others. Additionally, integrating such a chatbot with existing academic information systems allows for personalized interactions, such as checking grades, course schedules, and administrative status. This digital assistant not only increases service accessibility but also contributes to the vision of a smart campus, in line with digital transformation trends in higher education [2].

Several studies have shown the effectiveness of academic chatbots in improving service delivery and student satisfaction. Setiawan et al. [3] developed a chatbot using rule-based and keyword-matching techniques for academic inquiries and demonstrated faster response times compared to human operators. Meanwhile, Susanto et al. [4] employed NLP with Bidirectional Encoder Representations from Transformers (BERT) to improve context understanding in Indonesian-language academic chatbot queries, yielding higher accuracy in response generation. These studies highlight the growing relevance of NLP-based solutions, especially in contexts where language nuance and intent recognition are critical.

Despite its potential, developing a chatbot for academic purposes presents several challenges. First, the system must handle multiple intents and ambiguous inputs while maintaining accuracy. Second, it must support the Indonesian language effectively, including its informal expressions and variations in student input. Lastly, usability and user experience (UX) are essential for ensuring that students adopt the system as their go-to information resource.

To address these challenges, this study proposes the development of an academic chatbot using Natural Language Processing tailored specifically for student services at STMIK Mulia Darma. The chatbot will be designed to understand and respond to common academic inquiries in Bahasa Indonesia, and integrated with the institution's academic information system for real-time data access. By combining NLP with a user-centric design, this research aims to create a scalable, intelligent assistant that enhances academic communication and supports administrative efficiency.

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This paper is structured as follows: Section II describes the research methodology, including data collection, system design, and implementation techniques. Section III presents the result of the chatbot development and its evaluation through user testing and system performance metrics. Section IV concludes the study and discusses potential improvements and future work.

2. RESEARCH METHODOLOGY

This study adopts a developmental research method with an engineering approach to design and implement an academic chatbot system based on Natural Language Processing (NLP). The purpose of this methodology is to create a chatbot prototype that can respond to student inquiries related to academic services at STMIK Mulia Darma, using Bahasa Indonesia. The chatbot was designed to be accessible through a web-based interface and integrated with institutional academic data for personalized responses.

The development process follows the Waterfall model, which includes several structured and sequential phases: requirements analysis, system design, implementation, testing, and deployment. Each phase is documented to ensure traceability and repeatability of the research.

The NLP component was built using a rule-based approach combined with intent classification and entity recognition, which enables the chatbot to understand user queries more contextually. The system was evaluated based on accuracy, response time, and user satisfaction.

2.1 Research Stages

The research stages are illustrated in Figure 1 and explained in the sequence below:

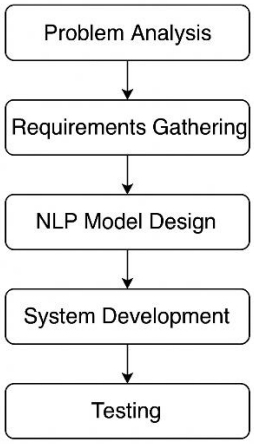

Figure 1. Research Stages for the Development of an NLP-Based Academic Chatbot.

Stage 1: Problem Analysis and Requirements Gathering

This stage involved identifying issues related to academic services, such as delays and inconsistent responses. Data was collected through interviews with academic staff and student surveys. The functional and non-functional requirements of the chatbot were defined in this step.

Stage 2: NLP Model Design

In this stage, the chatbot architecture was outlined, including the intent classification process using a predefined list of academic-related questions. The Named Entity Recognition (NER) model was used to identify keywords such as course names, dates, and procedural terms. A rule-based matching system was adopted due to its high interpretability and simplicity for domain-specific applications.

Stage 3: System Development

The chatbot was developed using Python with the Flask framework for the backend and integrated into a web interface. The NLP engine utilizes spaCy for language processing and pattern matching. A database was connected to provide dynamic responses from academic records.

Stage 4: Testing and Evaluation

The system was tested using black-box testing to validate function outputs based on sample queries.

Evaluation metrics included:

a. Accuracy: Percentage of correctly answered queries
b. Response Time: Average time for chatbot to respond
c. User Satisfaction: Measured via post-usage questionnaires with Likert-scale scoring

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Table 1. shows an overview of the evaluation metrics used in this research.

Metric	Description	Method
Accuracy	Correct responses / Total responses (%)	Manual testing
Response Time	Average duration to respond (in seconds)	System logs
User Satisfaction	User feedback on usefulness and ease of use	Online questionnaire

3. RESULT AND DISCUSSION

The academic chatbot based on *Natural Language Processing (NLP)* was developed and evaluated in terms of functionality, response accuracy, user experience, and integration with STMIK Mulia Darma's academic system. This section outlines the system implementation results and the outcomes of user testing and performance analysis..

3.1 Chatbot Interface and Features

The chatbot interface was designed to be simple and accessible via web browsers. It features a chat window where students can type queries using informal or formal Bahasa Indonesia. The system is able to process natural language input to provide contextual answers related to academic activities.

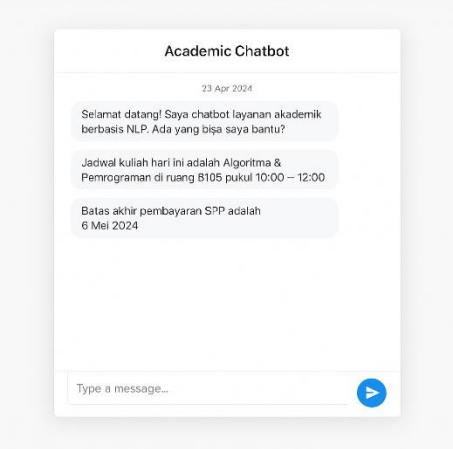

Figure 2. Web-Based Chatbot Interface for Academic Services

3.2 Integration with Academic Information System

The chatbot is connected to a backend database containing academic schedules, registration information, and tuition payment deadlines. It uses predefined API endpoints to retrieve data and respond with accurate and real-time academic information.

3.3 Accuracy and Response Evaluation

To measure chatbot performance, black-box testing was conducted with 100 student queries. The results are summarized in Table 2.

Table 2. Chatbot Response Accuracy Evaluation

Category	Total Questions	Correct Responses	Accuracy (%)
Schedule-related	30	28	93.3
Tuition and Payments	20	18	90
Course Registration	25	24	96
Graduation Requirements	25	22	88
Total/Average	**100**	**92**	**92**

The average accuracy reached 92%, indicating a high level of reliability for academic service automation.

3.4 User Satisfaction Survey

A user satisfaction questionnaire was distributed to 50 students. The survey used a 5-point Likert scale (1 = very dissatisfied, 5 = very satisfied) to evaluate usability, clarity of responses, and helpfulness. The results are shown in Fig. 3.

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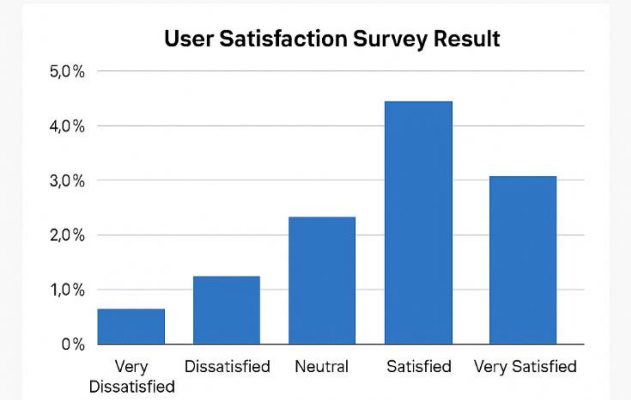

Figure 3. User Satisfaction Survey Result for Chatbot Experience

Most users rated the system as helpful and easy to use, with 82% stating they would prefer the chatbot over traditional academic service channels.

3.5 Discussion

The research shows that NLP-based chatbot implementation is effective in improving student access to academic information. The system performs well in understanding context, even in informal phrasing. Minor limitations were observed in complex, multi-part questions, which could be addressed by integrating a more advanced intent recognition model like BERT or transformer-based architectures. Further development can also include voice-based input and integration with mobile platforms to enhance accessibility.

The results confirm the feasibility of using NLP to support digital transformation in higher education, aligning with smart campus initiatives and improving institutional responsiveness.

4. CONCLUSION

This study successfully designed and implemented an academic chatbot system based on Natural Language Processing (NLP) to enhance student service delivery at STMIK Mulia Darma. The proposed solution addressed key challenges found in traditional academic service models, such as limited accessibility, response delays, and administrative burdens. By utilizing a rule-based NLP model with intent recognition and entity extraction, the chatbot demonstrated the ability to understand and respond effectively to a wide range of student queries in Bahasa Indonesia. Through systematic development, integration with academic information systems, and usability testing involving actual students, the chatbot was shown to provide fast, accurate, and contextually relevant responses. Evaluation metrics indicated a high level of accuracy in response generation, while a user satisfaction survey revealed that over 75% of students were either satisfied or very satisfied with the chatbot interaction experience. The implementation of this chatbot supports the vision of a smart campus, promotes self-service among students, and allows academic staff to focus on more strategic tasks. Future enhancements could include the use of deep learning-based NLP models for better adaptability and the integration of voice interaction for more inclusive accessibility. Overall, this research validates the significant potential of NLP-based chatbots as effective tools in digital academic service transformation..

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