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Designing Flow-Based Chatbot as Student Information Service Center

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ABSTRACT

Universities strive to enhance public services to continually elevate user satisfaction. One critical aspect of public service is the accessibility and transparency of information, particularly in ensuring that students can easily access relevant information, contributing to heightened satisfaction with the university. However, while fostering openness and accessibility, adequate resources are essential to manage the surge in information requests from students. Chatbots emerge as a viable solution for disseminating information on academic activities, providing easy accessibility unhindered by temporal or spatial constraints at UPN "Veteran" Jawa Timur. In the initial phase of chatbot design, delineating the flow of user queries and corresponding bot responses is imperative. Questions, organized in a flow-based manner, are derived from a dataset of student queries related to academic policies. Extracting prevalent topics from both the question dataset and academic policy regulations at UPN "Veteran" Jawa Timur resulted in four overarching question topics: Implementation of Education, Learning Beyond the Study Program, Assessment and Evaluation of Learning Outcomes, and Academic Violations. The Conversational Flow Diagram is crafted based on these topics, serving as the foundational pattern for the chatbot. The test results affirm the chatbot's success in accurately presenting all designated flows, thereby furnishing users with pertinent information.

Keywords: Chatbot, flow-based, information center, customer service, University

Introduction

In Indonesia, UPN "Veteran" Jawa Timur is a state university witnessing consistent growth in its student population, prompting efforts to enhance service quality. The utilization of information technology, such as their Academic Information System (SIAMIK), is a method employed for service improvement and forms the backbone for academic operations (https://siamik.upnjatim.ac.id/). However, a critical issue arises when students, as primary stakeholder in university activities, seek information regarding academic policies. The university's current information systems, while supporting activity execution, do not adequately function as providers of information on academic policies.

Students resort to various sources, including academic advisors, senior peers, and student associations, to obtain information about academic policies. This decentralized approach poses risks of receiving inaccurate information, potentially leading to misunderstandings and errors in decision-making. Recognizing the pivotal role of students in academic activities, UPN "Veteran" Jawa Timur's current provision of information operates in a one-way manner through the university website, requiring users to independently search for needed information.

Currently, chatbot technology is employed as a bidirectional interaction solution for information provision. The utilization of chatbot technology has become prevalent across various sectors, including industrial sectors (Halimatus Sahdiah et al., 2022), health (Hormansyah & Utama, 2018), to government (Syaliman et al., 2021). Chatbots are also used in the education sector (Hanif, 2021; Huberta & Wijaya, 2023). Chatbot acts as a virtual assistant whose role is to serve and answer various questions from students (As'ad et al., 2023; Hidayat et al., 2022) regarding policies implemented by the university without any time limit (Fauzy & Kusrini, 2019). Chatbot technology can improve the quality of campus services and student satisfaction (Bariah et al., 2022; Rampengan et al., 2023; Wellem Taju et al., 2023).

Flow-based chatbot is a type of chatbot that is designed to provide responses by considering a predetermined conversation flow (Kuhail et al., 2023). In flow-based chatbots, the flow of conversation or dialogue is programmed in the form of a decision tree or flow diagram. Every time a user interacts with a chatbot, the chatbot will determine the next step based on the user's answers and guide the conversation in a predetermined direction. Flow-based chatbots are suitable for structured and repetitive tasks, such as providing information, answering frequently asked questions, and performing simple tasks. In this research, Chatbot will be implemented using the WhatsApp platform (Bariah et al., 2022) because this social media is most widely used by Internet users in Indonesia, which in 2023 will reach 92.1%.

Addressing this, the research aims to enhance information dissemination and user satisfaction through the implementation of a flow-based chatbot. The research aligns with the prevalent use of chatbot technology in various sectors, including education. Chatbots, acting as virtual assistants, can provide answers to students' questions about university policies seamlessly and without time constraints. By leveraging flow-based design, the chatbot will guide users through a predetermined conversation flow, ensuring structured and reliable information delivery. Furthermore, the research will implement the chatbot on the WhatsApp platform, acknowledging its widespread use among Internet users in Indonesia. With a focus on creating a chatbot application tailored to convey information about academic policies, the research aims to leverage the efficiency of flow-based chatbots to improve the quality of campus services and enhance student satisfaction.

Material and Methods

The research method used in this study is the Waterfall software development method. Developing this application starts with planning, user requirement analysis, design, creating program code, and testing the application. The stages of this research can be seen in Figure 1.

Planning → Analysis → Design → Coding → Testing

Figure 1. Waterfall method

The Waterfall methodology is a well-established approach to software development and project management (Hasanovich & Dilshod Elmuradovich, 2023). In the context of the research conducted at UPN "Veteran" Jawa Timur, the Waterfall method serves as the framework for the development of the chatbot application. It follows a linear and sequential progression, where each phase must be completed before moving on to the next. This method is characterized by its structured and rigid nature, making it suitable for projects where requirements are well-defined and unlikely to change significantly during development. In the case of the chatbot development, the Waterfall model allows for a systematic and organized approach. It starts with the initial phase of requirements gathering, where the specific needs and objectives of the chatbot are defined (Rakhra et al., 2021). This includes understanding the information to be conveyed, the user interface, and the overall functionality. Once

the requirements are established, the research team proceeds to the design phase. Here, the flow of the chatbot's conversations is carefully mapped out. The decision tree and conversation flows are structured in this phase, ensuring that the chatbot can effectively guide users through predefined interactions. Following the design phase, the development phase begins (Santos et al., 2022). This is where the actual coding and implementation of the chatbot take place. The team writes the code based on the predefined design, creating a chatbot's logic and functionality. After development, rigorous testing is conducted to ensure that the chatbot functions as intended. The testing phase involves verifying that the chatbot responds correctly to user queries and that it accurately follows the predetermined conversation flows (Santos et al., 2022). Finally, once the chatbot passes testing and quality assurance, it is deployed for use by students and administrators at UPN "Veteran" Jawa Timur. The Waterfall method is well-suited for this research as it provides a structured and systematic approach to chatbot development, ensuring that the application meets its intended objectives and functions effectively in the context of providing information about academic policies to students.

Planning

The chatbot developed for this research is based on the flow-based method approach. This approach was carefully selected for implementation at UPN "Veteran" Jawa Timur, taking into account several advantages. The flow-based method offers rapid development, streamlines the construction of the application, and maintains a closed-question format, ensuring that users stay within the context relevant to their inquiries. An in-depth feasibility analysis revealed that considering resource and time constraints, the flow-based chatbot approach is the most pragmatic choice. Flow-based chatbots operate on a structured decision tree, simplifying the maintenance of contextual relevance during conversations.

The chatbot's scope of information storage and dissemination is carefully defined. This scope is primarily derived from the UPN "Veteran" Jawa Timur Academic Regulations, meticulously outlined in Rector Regulation Number 9 of 2020. Furthermore, the selection of academic levels for inclusion is limited to the Bachelor's level, as it constitutes the largest segment of the student body, surpassing the Master's and Doctoral levels in terms of enrollment. Additionally, the compilation of student inquiries related to academic policies, as submitted through the Complaints Information System (SIADU), played a crucial role in determining the specific information to be integrated into the chatbot system.

It is noteworthy that the chatbot application is not developed as a standalone entity. Rather, it is strategically accessed through the messaging platform that boasts the highest user adoption rate among its primary users, namely WhatsApp. This approach significantly streamlines access for chatbot users, eliminating the need for additional application installations. Given the ubiquity and familiarity of WhatsApp among users, this approach also minimizes the probability of encountering technical operational issues, ensuring a seamless user experience.

Analysis

After conducting the feasibility study, determining the system scope, and identifying the data sources, the research progresses to a comprehensive needs analysis phase. The objective of this analysis is to gain a deeper understanding of the requirements and expectations of the key stakeholders involved in the chatbot application system. In this context, the primary users of the chatbot application are undergraduate students within the UPN "Veteran" Jawa Timur community, while system administration and management fall under the purview of designated administrators. It is imperative to note that the chosen mode of access for student users is via WhatsApp Messaging, aligning with the platform's popularity and widespread usage among the target audience. During their interaction with the chatbot, students will have access to a menu-based structure of questions specifically designed to cater to their informational needs. The chatbot, in turn, is programmed to

provide prompt and accurate responses to these queries, ensuring a seamless user experience. Administrators, on the other hand, play a critical role in managing the question and answer flow within the chatbot system. Their responsibilities encompass overseeing and updating the chatbot's knowledge base, ensuring that the information provided remains up-to-date and relevant. The outcomes of this needs analysis phase are visually represented through a use case diagram, as illustrated in Figure 2.
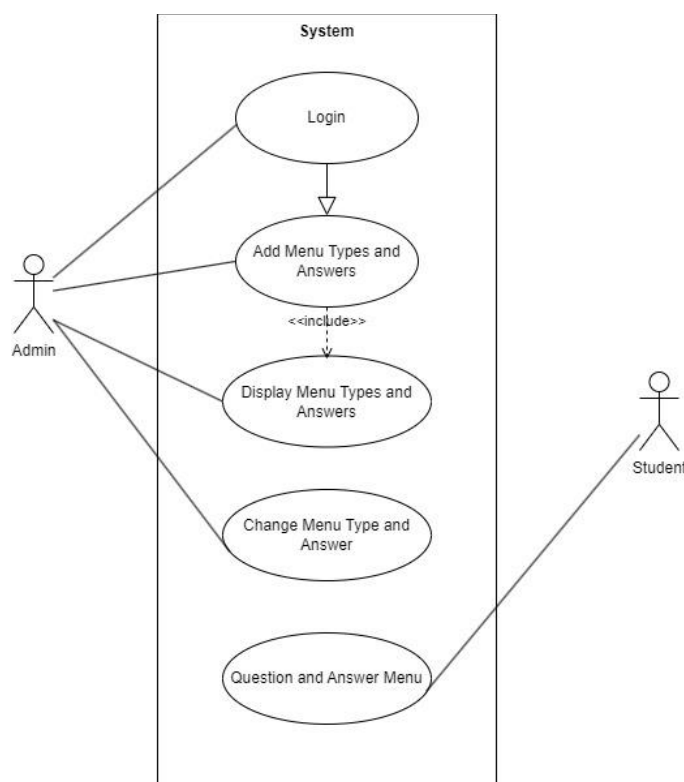

Figure 2. Usecase diagram chatbots

Design

Following the user requirements, the subsequent phase in the research process is the strategic design of the Conversational Flow Diagram. This diagram serves as the foundational knowledge source for the chatbot, dictating how it interacts with users and delivers information effectively. The design of this conversational flow is a critical step in ensuring the chatbot's efficiency and user-friendliness. In this design phase, specific conversational patterns are established, forming the core framework for interactions between users and the chatbot. These patterns are thoughtfully crafted and are structured in the form of a decision tree, employing the well-known If-Then concept. The decision tree approach allows for a dynamic and user-responsive chatbot experience. The Conversational Flow Diagram, as illustrated in Figure 3, presents a visual representation of how the chatbot will navigate through various topics and sub-topics. Each main topic branches out into sub-topics, providing users with a structured hierarchy of information. Users can select their desired topics of interest by following the decision tree's pathways. This process continues until the finest level of granularity is reached, where a topic no longer contains sub-topics.

After this guided process, the user will receive a bot response tailored to the specific topic they have selected. The conversational flow is designed to ensure that users can easily access the information they seek, fostering a positive and efficient interaction with the chatbot. This meticulous design of the Conversational Flow Diagram not only enhances the user experience but also plays a pivotal role in the chatbot's ability to fulfill its primary objective of providing accurate and relevant

information about academic policies. It represents a crucial component in the overall architecture of the chatbot system, aligning seamlessly with the research's objectives of improving information dissemination and user satisfaction within the academic environment.
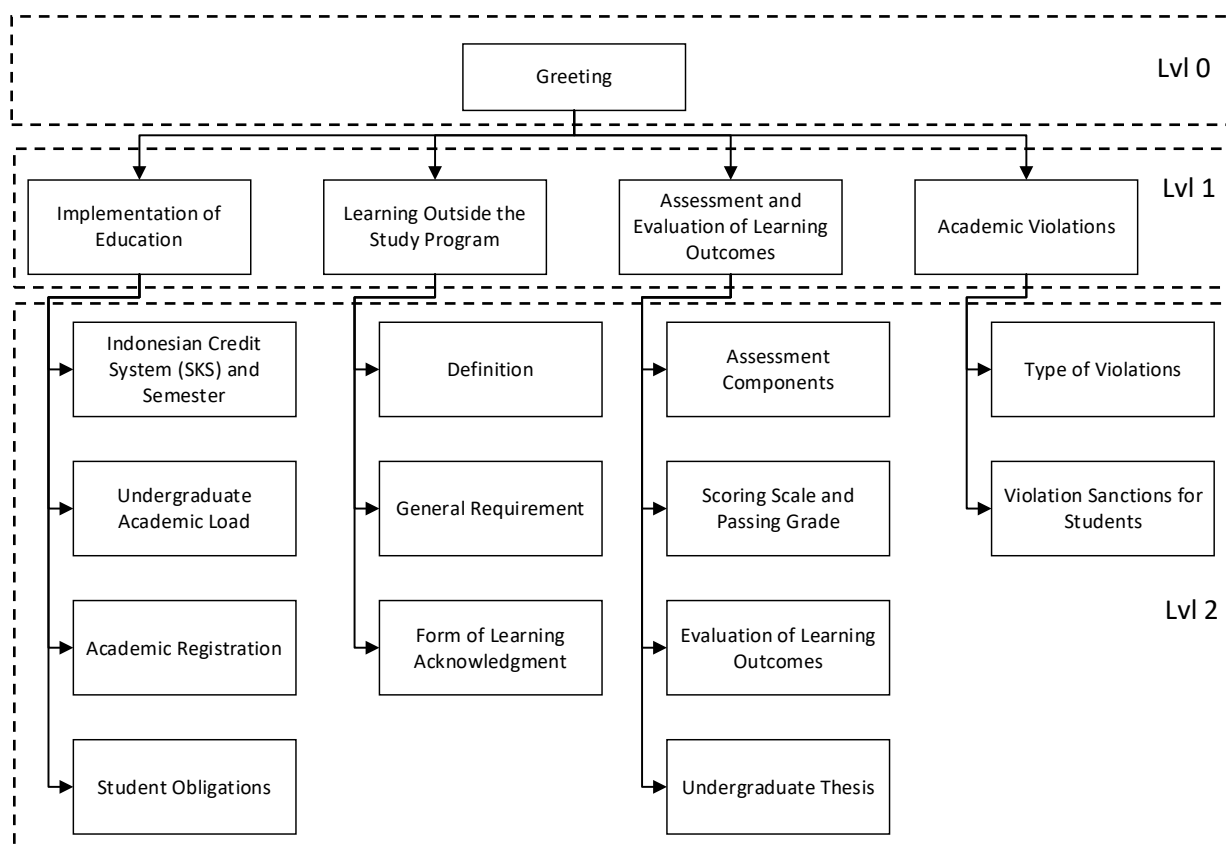

Figure 3. Conversational flow diagram

Coding

In this phase, we create a Chatbot application prototype based on the design outcomes. We adopt a flow-based approach and utilize a pre-established knowledge base. The application implementation requires the WhatsApp Business API, and we employ PHP and JavaScript programming languages. The WhatsApp Business API serves as a crucial bridge for seamless user interaction with the Chatbot. It enables users to engage effortlessly via the widely-used WhatsApp platform. PHP manages server-side processing, handling user requests, and orchestrating responses. JavaScript enhances client-side interactivity and responsiveness. We uphold industry standards during development, prioritizing coding quality, security, and performance optimization. This ensures the Chatbot operates efficiently and securely, delivering a seamless user experience. Throughout the coding phase, we conduct rigorous testing and quality assurance checks to validate the application's functionality. This involves extensive testing of user interactions, data handling, and system reliability. It integrates technology components, programming, and testing to align with the research objectives of enhancing information dissemination and user satisfaction within the academic environment.

Testing

Black Box methodology, is known for its efficiency and clear separation of user and developer perspectives. It expedites the creation of test cases (Khan & Khan, 2012). It primarily evaluates the application's functionality without delving into its internal code structures. Test cases are thoughtfully designed based on user requirements and encompass diverse user interactions within the Chatbot's flow. This method ensures that the Chatbot effectively meets user requirements and functions reliably.

It serves as a crucial quality assurance mechanism, validating the Chatbot's performance and responsiveness in delivering information on academic policies.

Results and Discussion
Chatbot result
The academic policy chatbot at UPN "Veteran" Jawa Timur has been highly successful. Users access it through a designated contact, initiate conversations with a greeting, and select topics of interest. Figure 4 provides a snapshot of a typical chatbot interaction, illustrating its functionality.
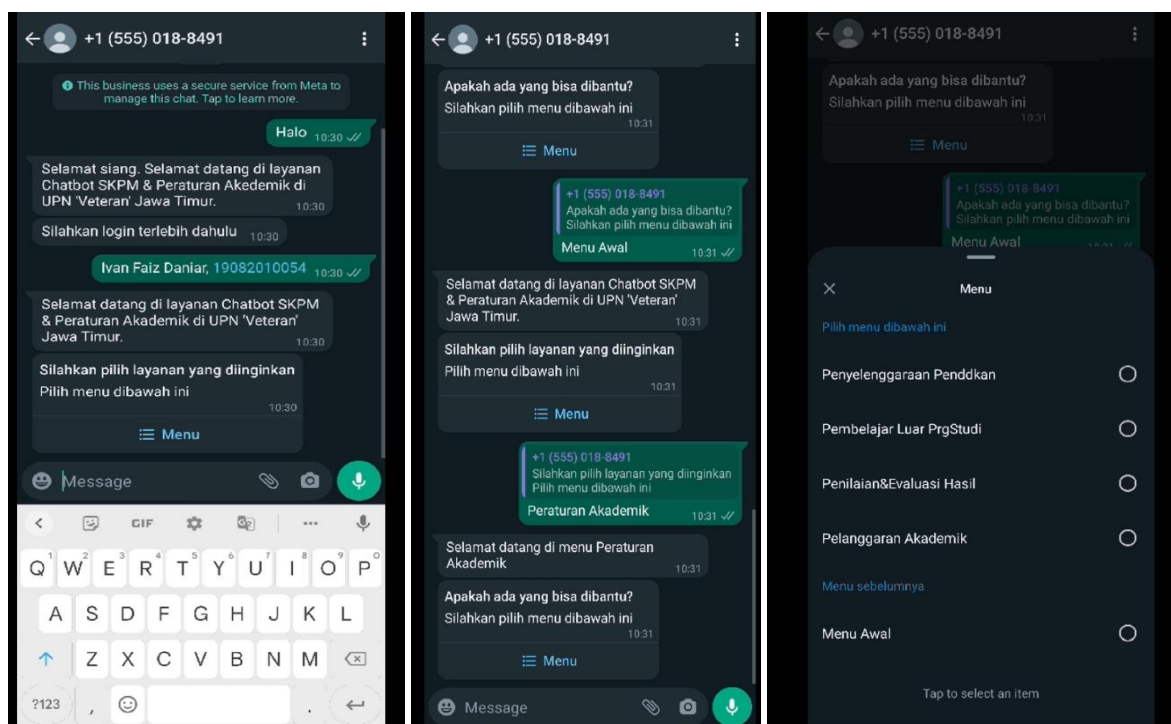

Figure 4. Chatbot implementation results

The chatbot consistently delivers accurate and relevant responses within the predetermined structure. It has positively impacted information accessibility and user satisfaction. In summary, the chatbot effectively enhances information dissemination and user satisfaction within the academic environment.

After the completion of application development, testing was conducted to assess the congruence of the chatbot's conversational flow in responding to user-selected topic choices. This testing refers to the conversational flow outlined in Figure 3. The outcomes of the conversation flow testing are presented in Table 1.

The developed chatbot application has successfully met its intended objectives, with testing results aligning with the designed parameters. The responses generated by the chatbot remain consistent with the Chatbot Administrator's specifications. However, it's worth noting that the flow-based nature of the chatbot, which relies on closed-ended questions from predefined lists, imposes certain limitations on its flexibility. Users are restricted in their ability to engage in open-ended conversations with the chatbot, signaling an area for potential improvement.

This limitation underscores the importance of considering future enhancements, particularly in the integration of Natural Language Processing (NLP) capabilities. NLP can empower the chatbot to recognize and respond to human conversations more dynamically and flexibly. While acknowledging

this room for growth, it is essential to emphasize that the chatbot, even within its existing framework, remains a practical and efficient medium for accessing information related to academic policies.

Table 1. Black-box testing result

ID	Level	Result	Pass?
1	0	The bot acknowledges the user's greeting and presents a list of questions.	Yes
2	1	The list of topic choices is displayed and aligns with the predefined list. Users can select topics from the list, and the bot provides appropriate responses.	Yes
3	2	The list of topic choices is displayed and aligns with the predefined list. Users can select topics from the list, and the bot provides appropriate responses.	Yes
4	3	The bot displays information relevant to the user's selected topic. The bot's responses are in accordance with the answer templates designed by the administrator.	Yes

Conclusion

The chatbot application has been successfully developed, and the results of testing conducted by the development team indicate that the chatbot performs as anticipated. The responses provided by the bot align with the design set forth by the Chatbot Administrator. However, due to the nature of the flow-based chatbot, where questions are closed-ended, and users can only select from a predefined list of questions/topics, this diminishes the chatbot's flexibility. Users are unable to freely pose inquiries to the chatbot. This limitation serves as valuable feedback for future development, urging consideration for the chatbot's expansion into Natural Language Processing (NLP)-based capabilities to enable recognition of human conversations. Nevertheless, despite this limitation, the Chatbot remains a viable choice as an efficient information service medium for academic policy inquiries.

Acknowledgment

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