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Design and Development of UBARA Chatbot (Universitas Bengkulu Academic Response Assistant) as an Integrated Information Service for the Academic Community and General Public

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Abstract*— This research aims to design and develop the UBARA Chatbot (Universitas Bengkulu Academic Response Assistant) as an integrated information service solution accessible to both the academic community and the general public. The primary challenge identified is the fragmented distribution of academic information across various platforms, which complicates the process for users to obtain information quickly and accurately. The chatbot system was developed using a Natural Language Processing (NLP) approach to interpret user input in natural language and provide relevant responses based on the available knowledge base. The system architecture consists of a React-based frontend for the user interface, a Node.js-based backend for system logic management, and a language processing module that handles query interpretation and information retrieval. Implementation results demonstrate that the chatbot is capable of providing rapid and accurate responses tailored to user needs, regarding both academic inquiries and general university information. Functional testing indicates that the system operates according to the designed scenarios and is capable of handling various types of user queries. Consequently, the UBARA Chatbot serves as an effective solution for enhancing information service accessibility, reducing administrative workload, and supporting digital transformation within the Universitas Bengkulu environment.

Keywords- CCS CONCEPTS, Artificial Intelligence, Information Systems Applications, Natural Language Processing, Chatbot, Natural Language Processing, Information Services, Information Systems, University of Bengkulu

I. INTRODUCTION

Digital transformation in higher education has driven significant changes in how information is delivered and accessed. Recent international studies highlight that modern academic institutions are increasingly relying on automated digital infrastructures to manage large-scale inquiries and reduce administrative burdens [1]. Statistical evidence from these global shifts indicates a growing reliance on AI-driven communication channels, where chatbots are utilized to streamline services and provide real-time support [2]. Students, prospective applicants, and the general public now demand information services that are fast, accurate, and accessible at any time. The University of Bengkulu faces challenges in managing complex academic information, ranging from curriculum details to public services. The primary issue lies in the fragmentation of information across various media, which creates inefficiencies for users and increases the workload for administrative staff.

As a solution, chatbots based on Natural Language Processing (NLP) have emerged as an effective approach. In the early stages, chatbots were generally built using a rule-based system that relied on simple keyword matching patterns [3]. Early development at the University of Bengkulu pioneered the use of Feed Forward Neural Networks as a self-learning instrument [3]. Furthermore, chatbot implementation for specific services, such as New Student Admissions (PMB) via instant messaging platforms, has been executed using Node.js architecture to enhance information accessibility [4].

Along with technological advancements, research has begun to adopt more systematic information processing techniques to understand natural language with greater flexibility [5], [6]. The application of comprehensive text processing methods has proven capable of optimizing information retrieval within large knowledge bases [6], [7]. Various studies indicate that integrating NLP into instant messaging systems or web platforms significantly improves the effectiveness of digital information services [8].

However, chatbot implementation still faces hurdles regarding official data integration and answer validity. The use of prototyping methods and evaluation through the System Usability Scale (SUS) is essential to ensure that the developed system truly meets user needs [9]. A clear documentation structure and conceptual framework are required when designing integrated information systems [10]. Additionally, developing architectures that separate system components modularly has been shown to increase language processing efficiency in addressing academic inquiries [11].

Based on these issues, this research proposes the development of the UBARA Chatbot. This system is designed using an NLP approach that focuses on keyword matching accuracy and academic knowledge base integration. With a decoupled frontend and backend architecture, the UBARA Chatbot is expected to serve as an effective, integrated information service solution for the entire academic

community of the University of Bengkulu and the general public.

II. METHOD

A. UBARA Chatbot System Architecture

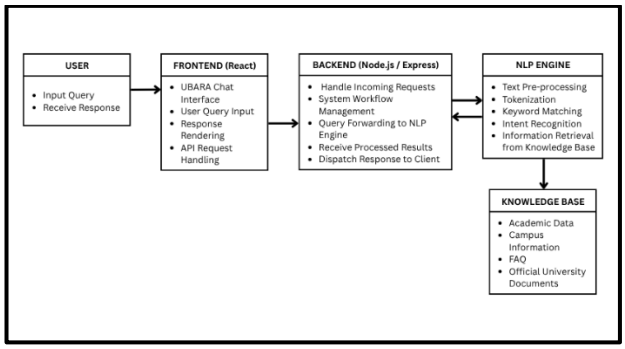


Fig. 1. System Architecture of UBARA Chatbot Based on Natural Language Processing

The development of the UBARA Chatbot is carried out using a service-oriented architectural approach, which decouples the system components into several primary sections: frontend, backend, and language processing modules. This approach aims to enhance flexibility, ease of development, and efficiency in system management.

At the frontend layer, the system is built using React, which functions as the user interface for interacting with the chatbot. This interface is designed as a responsive chat widget, ensuring usability across both desktop and mobile devices.

The backend layer is developed using Node.js, serving as the system logic manager and the bridge between the user interface and the language processing module. The backend is responsible for receiving user input, processing requests, and delivering responses back to the user.

The language processing module utilizes a Natural Language Processing (NLP) approach to understand the intent behind user inquiries. This process involves text preprocessing, keyword identification, and matching with the knowledge base to generate relevant answers. The system's knowledge base contains a collection of academic information and public services sourced from official university data.

B. UBARA Chatbot Functional Workflow

The system workflow begins when a user submits an inquiry through the chat interface. This inquiry is subsequently transmitted to the backend for further processing.

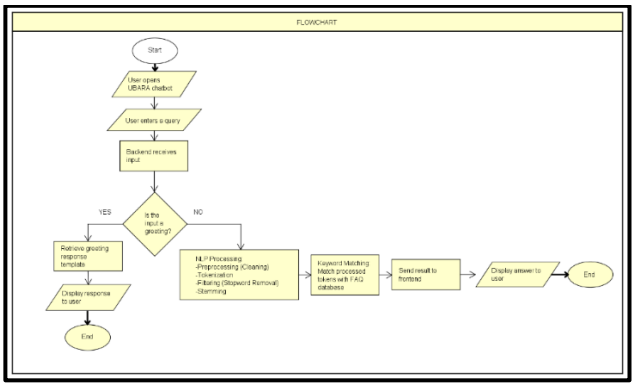


Fig. 2. Flowchart of the UBARA Chatbot System Workflow

The first stage involves the input type identification process. If the input consists of a greeting or simple conversation, the system provides an immediate response without initiating an information search. However, if the input is an informational inquiry, the system proceeds to the language processing stage using NLP. This stage entails text preprocessing, sentence tokenization, and keyword matching against the data available in the knowledge base. Subsequently, the system retrieves the most relevant information and formulates it into a user-friendly response. This response is then transmitted back to the user interface as the chatbot's final answer.

C. Language Processing Techniques

In this study, Natural Language Processing (NLP) techniques are employed to enhance the chatbot's ability to understand user inquiries. The language processing stages implemented include:

1. Text Preprocessing

   This process involves cleaning the text by removing unnecessary characters, normalizing case, and eliminating punctuation to facilitate easier analysis.

2. Tokenization

   User-inputted sentences are broken down into individual word units or tokens to streamline the process of meaning identification.

3. Keyword Matching

   The system identifies the primary keywords from the user's question and matches them against the data available in the knowledge base.

4. Response Generation

   Based on the matching results, the system generates an appropriate answer and structures it into an informative sentence format.

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III. Result And Discussion

A. System Realization and Functional Testing

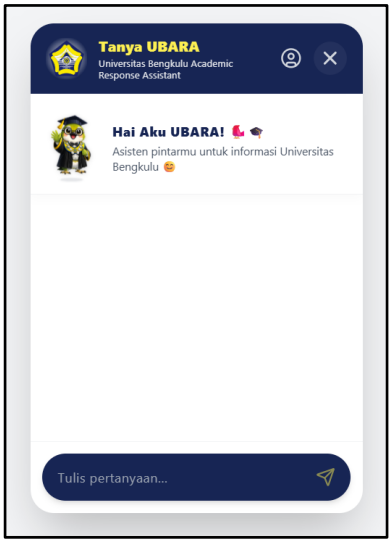


Fig. 3. UBARA Chatbot Interface Display

A critical phase following the development process is the technical realization and functional testing of the system. Technically, the UBARA prototype is developed as a responsive web widget interface, ensuring easy accessibility through both the internal student portal and the general public's mobile devices.

B. System Functional Testing (Black Box Testing)

Black Box testing was conducted to validate the interface functionality and the consistency of the system output without reviewing the internal code structure. The testing scenarios modeled various query variations commonly asked by current and prospective students to ensure that system responses align with the expected outcomes.



Fig. 4. Example of User Interaction with the UBARA Chatbot

Each response includes implicit references from documents retrieved within the knowledge base, providing a higher level of credibility for all user segments.

Table 1. Recapitulation of Functional Validation and UBARA Workflow Execution

Testing Scenario	User Input (Simulated Query)	System Workflow Response Expectation	Status
Social Interaction	"Hi" / "Hello UBARA"	The system responds to greetings directly without further processing.	Success
Public Information	"How do I register at UNIB?"	The system processes input using NLP and displays registration information	Success
Directory Information	"Faculties at UNIB"	The system displays a list of faculties based on available data.	Success
Financial Sensitivity	"Tuition fees/UKT?"	The system displays UKT information according to the knowledge base.	Success
Hallucination Protection	"Random text"	The system provides a response indicating that the information was not found.	Success

C. System Response Quality Measurement

The UBARA chatbot system demonstrates robust performance in responding to various user inquiries. The system's response time is characterized as rapid and stable when handling user requests in real-time. In terms of answer quality, the system is capable of providing highly relevant information based on the data available within the knowledge base. Furthermore, the implementation of a Natural Language Processing (NLP) approach assists the system in understanding diverse variations of user queries. To empirically validate this capability, functional validation testing across multiple scenarios (as shown in Table 1) demonstrated a 100% success rate in workflow execution and intent recognition. Benchmark comparisons in recent studies indicate that integrating dynamic NLP models significantly reduces misinterpretation rates compared to traditional rule-based systems, which rely on rigid keyword matching (Kooli, 2023). This ensures that the generated responses precisely align with the requested information needs.

IV. Strategic Benefits In Academic Information Services

The development of the UBARA system catalyzes an institutional-scale cultural and strategic shift:

1. Transformation of Inclusive Accessibility

   UBARA establishes a pillar of 24-hour self-service assistance, effectively reducing information barriers for prospective students from remote areas who require instantaneous information.

2. Reduction of Public Relations and Administrative Workload

   UBARA serves as a frontline interface that addresses thousands of repetitive queries, allowing administrative and PR staff to focus more on managing highly complex service cases.

3. Flexible Data Maintenance

   Updates regarding registration information or new regulations can be executed by simply updating the system's knowledge base. This ensures that the information provided by the chatbot remains relevant without necessitating structural changes to the core system.

4. Standardization of Public Information

   It guarantees that the information received by the general public is identical to official documents, thereby maintaining the university's reputation and transparency.

V. CONCLUSION

This research has successfully designed and developed the UBARA Chatbot as an integrated information service solution at the University of Bengkulu. The system was developed using a Natural Language Processing (NLP) approach, enabling the chatbot to understand user inquiries in natural language and provide relevant responses based on the available knowledge base. Implementation and testing results demonstrate that the system operates effectively, delivering rapid responses that align with user needs. The UBARA Chatbot is also proven to enhance information service efficiency by reducing administrative workload and providing easier access to information for both the academic community and the general public. Consequently, the UBARA chatbot serves as an effective solution to support the digital transformation of information services within the higher education environment.

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