

## Counselling Chatbot Development with Natural Language Processing and AI

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### ABSTRACT

Colleges offer counseling services and provide information to prospective students, typically through direct interactions at the institution, over the phone, or via social media accounts listed on the college website. However, increasing visitor numbers have led to longer wait times due to limited availability of staff, resulting in lower satisfaction among prospective students. Additionally, these services are only accessible during regular business hours. To address this issue, one potential solution is to implement a chatbot to handle frequently asked questions from prospective students. This study explores the development of an intelligent chatbot with voice input for college admissions using Natural Language Processing (NLP) and AI. In this paper, the chatbot's performance was evaluated using both the Chatbot Usability Questionnaire (CUQ) and a Confusion Matrix. The findings revealed that the chatbot effectively and accurately responded to questions within its knowledge base.

**Keywords:-** AI, Chatbot Usability Questionnaire, Confusion Matrix, *Machine Learning*.

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### I. INTRODUCTION

A chatbot is a computer software that simulates human interaction using spoken and written language. These bots can interact with users at any time and are programmed to respond to specific phrases or commands. They are also known as intelligent virtual assistants, virtual customer assistants, or conversational agents. The use of Artificial Intelligence (AI) in education is growing rapidly, and chatbots are one of the most widely used AI systems to enhance teaching and learning activities [1]. In educational settings, chatbots can be utilized for various purposes, including teaching, learning, management, assessment, consulting, and research and development.

In higher education, chatbots can assist students with tasks such as completing financial assistance applications, enrolling in classes, and obtaining admissions information. The concept of chatbots dates back to 1966 with the creation of ELIZA, which facilitated natural language conversation between humans and machines. Chatbots can range from simple to advanced levels of AI, making them a key model of human-computer interaction [2].

AI chatbots differ from traditional rule-based chatbots as they can understand and respond to human interactions using advanced natural language processing (NLP), natural language understanding (NLU), and natural language generation (NLG) techniques [3]. These chatbots use machine learning algorithms, enabling them to become smarter over time. Chatbots are valuable in various fields, including healthcare, education, e-commerce, business, and entertainment, by enhancing productivity, providing entertainment, and offering unique interaction opportunities [4].

In higher education, most students have access to smartphones and frequently use internet-based applications. Chatbots have become increasingly popular for supporting learning by providing real-time, standardized information such as course content, practice questions, evaluation criteria, assignment deadlines, advice, campus directions, and study materials. These systems not only enhance student support and engagement but also reduce the administrative workload of lecturers, allowing them to focus more on curriculum development and research. Chatbot technology offers students an engaging and personalized learning environment [5].

The use of chatbots in education can improve students' learning experiences and assist faculty members by automating classroom processes [6]. Chatbots enhance connectivity, efficiency, and predictability in interactions and can facilitate communication in technical institutions. They improve student interaction and collaboration, providing personalized learning environments, intelligent feedback, virtual assistance, efficient teaching, and immediate support [7].

One of the challenges with the admissions process is that students often need to directly communicate with the university to get answers to their questions. A significant issue for students seeking entry into graduate programs is the difficulty in obtaining clear information about the admission and registration processes. Students often spend a lot of time searching through university websites for accurate information, which can be frustrating as they navigate through various pages and links. Questions may include registration dates, available programs, required tests, and other details. Even visiting the university in person to get answers requires time, effort, and navigating procedures on campus.

A chatbot can address these issues by providing quick, reliable information and serving multiple students simultaneously. This study developed an intelligent chatbot system that allows students to easily access information about the admissions process in higher education. Figure 1 show chatbot process with NLP.

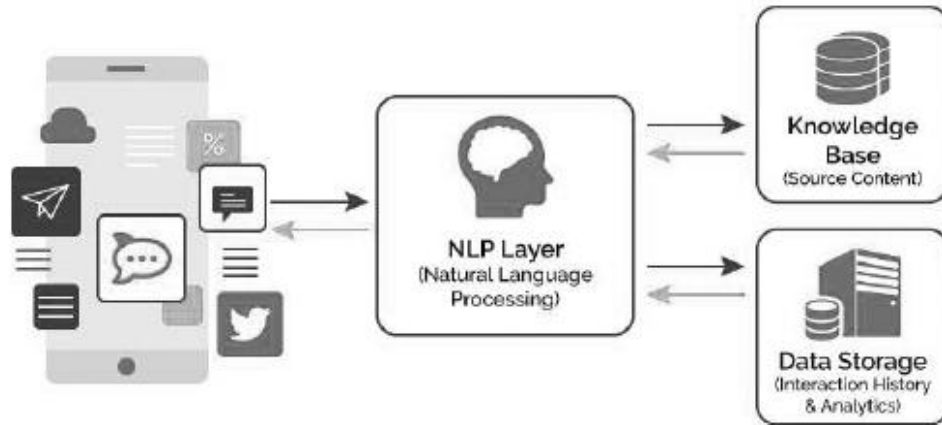


Figure 1: Chatbot Process with NLP

## II. LITERATURE REVIEW

In recent years, the widespread adoption of chatbots across various industries has been fueled by advancements in artificial intelligence (AI) and natural language processing (NLP) technologies. This literature review examines several key studies that highlight the development, applications, and challenges of chatbots in different sectors.

Rapp, Curti, and Boldi [8] conducted a systematic literature review on the human side of human-chatbot interaction. Their research, published in the *International Journal of Human-Computer Studies*, provided insights into user perceptions, attitudes, and behaviors when interacting with text-based chatbots, shedding light on the factors influencing user satisfaction and trust.

Nguyen et al. [9] introduced the EU-chatbot, a chatbot designed for admission purposes at the National Economics University. Published in *Computers and Education: Artificial Intelligence*, their study demonstrated the application of chatbot technology in educational settings, focusing on streamlining admission processes and providing timely assistance to prospective students.

Nguyen, Tran, and Pham [10] proposed an ontology-based integration of knowledge base for building an intelligent searching chatbot. Their research, published in *Sensors and Materials*, emphasized the importance of structuring knowledge to enhance the chatbot's ability to retrieve relevant information and respond effectively to user queries.

Gunawan et al. [11] developed an intelligent Telegram chatbot using natural language processing techniques. Presented at the 7th International Conference on Wireless and Telematics, their work showcased the practical implementation of chatbot technology in messaging platforms, facilitating efficient communication and information retrieval.

Ayanouz, Abdelhakim, and Ahmed [12] presented an intelligent chatbot utilizing NLP and TF-IDF algorithm for text understanding in the medical field. Published in the proceedings of the NICE2020 International Conference, their study highlighted the potential of chatbots to assist healthcare professionals and patients by understanding and processing medical-related inquiries.

Christopherjames et al. [13] introduced a natural language processing-based human assistive health conversational agent designed for multi-users. Presented at the Second International Conference on Electronics and Sustainable Communication Systems, their work focused on leveraging chatbots to provide personalized health assistance, demonstrating the potential of NLP in improving healthcare services.

Okonkwo and Ade-Ibijola [14] conducted a systematic review on chatbot applications in education. Published in *Computers and Education: Artificial Intelligence*, their study provided insights into the diverse educational contexts where chatbots are employed, highlighting their role in facilitating learning activities, providing personalized feedback, and enhancing student engagement.

Jadhav, Mulani, and Jadhav [15] explored the design and development of a chatbot based on reinforcement learning principles. Their research, published in *Machine Learning Algorithms for Signal and Image Processing*, focused on enhancing chatbot performance through adaptive learning mechanisms, showcasing advancements in chatbot technology driven by machine learning techniques.

Siswanto et al. [16] developed an interview bot using NLP and machine learning approaches. Published in the *International Journal of Technology*, their work demonstrated the application of chatbots in streamlining interview processes, emphasizing the importance of NLP in understanding and responding to interview-related inquiries.

Wong [17] proposed the design of an intelligent chatbot with NLP capabilities to support learners. Presented in the *Journal of Physics: Conference Series*, their study highlighted the potential of chatbots in educational settings, particularly in providing personalized learning experiences and adaptive feedback to learners.

Khurana et al. [18] conducted a comprehensive review on the state of the art, current trends, and challenges in natural language processing. Their work, published in *Multimedia Tools and*

Applications, provided a comprehensive overview of NLP techniques, algorithms, and applications, laying the groundwork for understanding the advancements in chatbot development.

Pandey et al. [19] developed a mental healthcare chatbot based on NLP and deep learning approaches. Published in the International Journal of Information Technology, their research demonstrated the potential of chatbots in mental health support, emphasizing the importance of personalized and context-aware interactions.

Nguyen et al. [20] designed an intelligent educational chatbot for information retrieval based on integrated knowledge bases. Presented in the IAENG International Journal of Computer Science, their study showcased the integration of NLP and knowledge base systems to enhance the chatbot's ability to provide relevant educational resources and support to users.

Zhou et al. [21] conducted a proof-of-concept pilot study on an artificially intelligent chatbot designed to promote COVID-19 vaccination. Published in Digital Health, their research demonstrated the use of chatbots in public health campaigns, highlighting their potential in disseminating information and promoting health behaviors.

Kasthuri and Balaji [22] proposed a chatbot using long short-term memory algorithms for natural language processing and deep learning. Presented in Materials Today: Proceedings, their work showcased advancements in deep learning techniques for improving chatbot performance in understanding and generating natural language responses.

Aloqayli and Abdelhafez [23] developed an intelligent chatbot for admission in higher education. Published in the International Journal of Information and Education Technology, their study focused on streamlining admission processes using chatbot technology, highlighting the importance of user-friendly interfaces and efficient information retrieval mechanisms.

### **III. ARCHITECTURE AND PROPOSED WORK**

As can be seen in Figure 2, the architecture of the counseling Chatbot System is composed of two phases:

A. User Interface.

B. Backend system

### **A. User Interface**

In the beginning, the user enters text by using keyboard or speak message using mic. The system first convert audio to text in the text box. After processing the message from back end the user interface show the response.

Example: What is the college counselling

### **B. Backend system**

The backend system has three part Information Analysis, Chatbot and Information storing and matching algorithms. First message come from user the system analysis the message that is it is keyword or phrases then send it to chatbot. The chatbot convert the message to natural language and send it to nest level. At the last portion we apply matching algorithm from stored data. If math found then reply to chatbot. The chatbot convert it to from natural language to user understanding language. After that the responses from chatbot send it to user interface for display.

In this method we used two matching algorithms one is Keyword matching and other is Phrase-based.

*Keyword matching:* The keyword matching algorithm will look for keywords in a message. An answer will be retrieved if keywords are detected in the user’s input text. Table I represents an example of the keyword to understand better how the keyword matching algorithm works. It represents instances from the chatbot. The first row shows the chatbot retrieved when it recognizes one keyword.

Table I: Keyword Matching Algorithm

<b>Question</b>	<b>Answer</b>	<b>Keyword</b>
Counselling	College counselors provide guidance, support and resources to help students overcome personal, academic and emotional difficulties.	Counselling
Registration	First you go to online registration portal then register your self by filling your details.	Registration
Fees	After successfully verify your document you need to deposit fees on your allotted college.	Fees

Phrase-based: The phrase-based algorithm compares the chatbot’s prestored queries with the user’s inquiry and discovers the best match in the chatbot datastore. Most frequently asked questions were saved as prestored questions, so that the student’s query was compared with this previously stored phrase and the chatbot displays the relevant response to the user. Table II displays the chatbot’s example of the phrase-based algorithm.

Table II. Phrased-Based Algorithm

Question	Answer	Phrase-based
Steps of counseling	The counselling process includes registration, choice filling, seat allotment, document verification and fee payment.	Steps of counseling

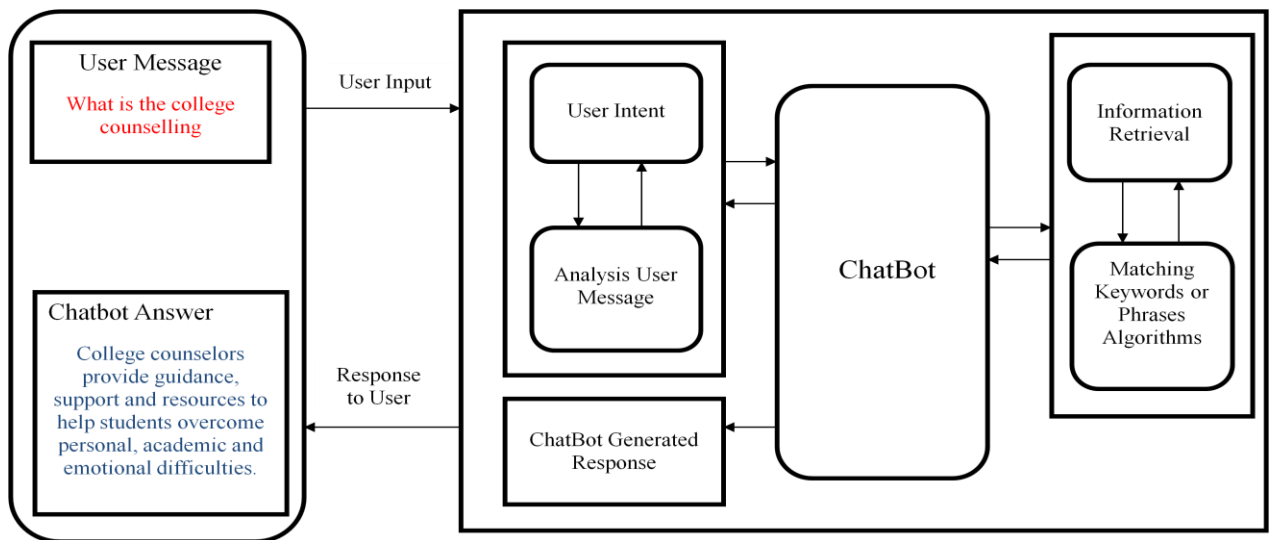


Figure 2: Architecture Module of Chatbot

#### IV. EXPERIMENTS AND RESULTS

It does not matter which platform you use to implement the Chatbot System; it may be done on either Windows or Linux computer systems. The Chatbot system that was built features a graphical user interface that is easy to use. In the experiment of the system, the Naïve Bayes Classifier was utilized as the algorithm for classification. Several different similarity functions are utilized in the testing process, which is carried out on the text-based dataset. It is shown here in the article that the result for the same is shown and the article concludes with a similarity graph.

Expanding our understanding of the causes, substance, and effects of human-machine communication is becoming increasingly important as chatbots continue to grow in prevalence and interaction with non-human agents becomes an integral part of daily life. We expect that the group receiving chatbot therapy will exhibit significantly lower levels of depression compared to the control group. Additionally, we anticipate that the chatbot therapy group will show significantly better outcomes in anxiety levels and quality of life. The model achieved an accuracy of 77%.

These findings suggest that chatbots could serve as a valuable and practical tool for delivering depression therapy. However, further research is needed to determine the optimal design and implementation of chatbot-based therapies for depression.

Accuracy score creates a confusion matrix using the sklearn metrics package and calculates the accuracy using (1).

$$Accuracy = \frac{(matrix[0][0] + matrix[-1][-1])}{np.sum(matrix)} \quad (1)$$

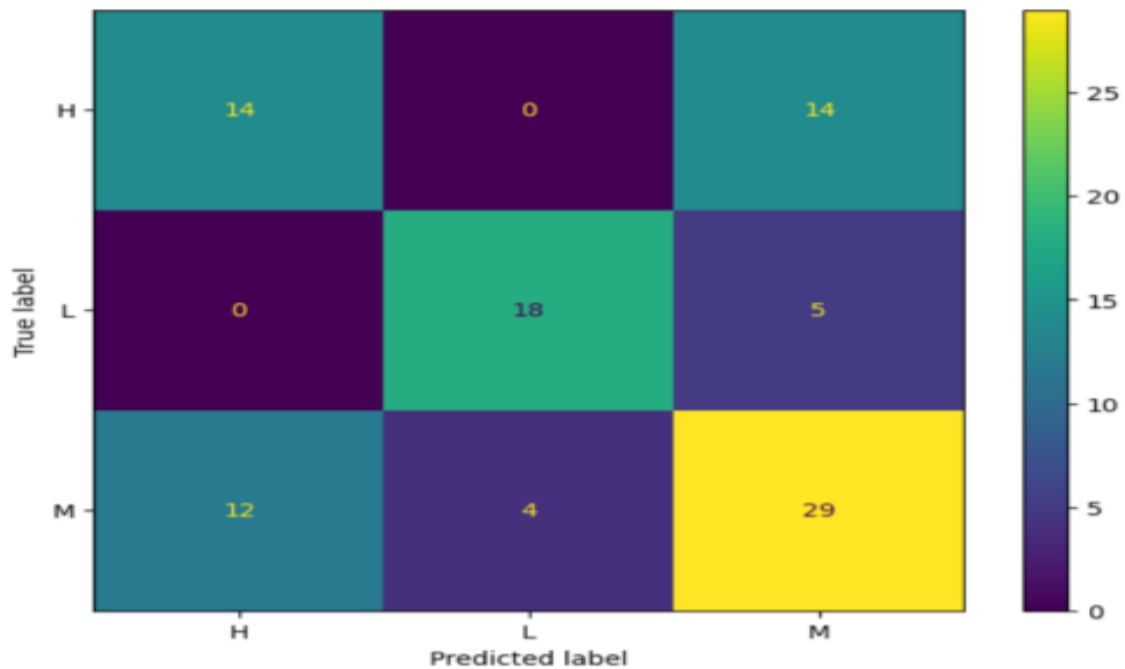


Figure 3: Confusion matrix

After inserting values from figure 3 in (1), we calculate our accuracy which comes out to be 77 percent.



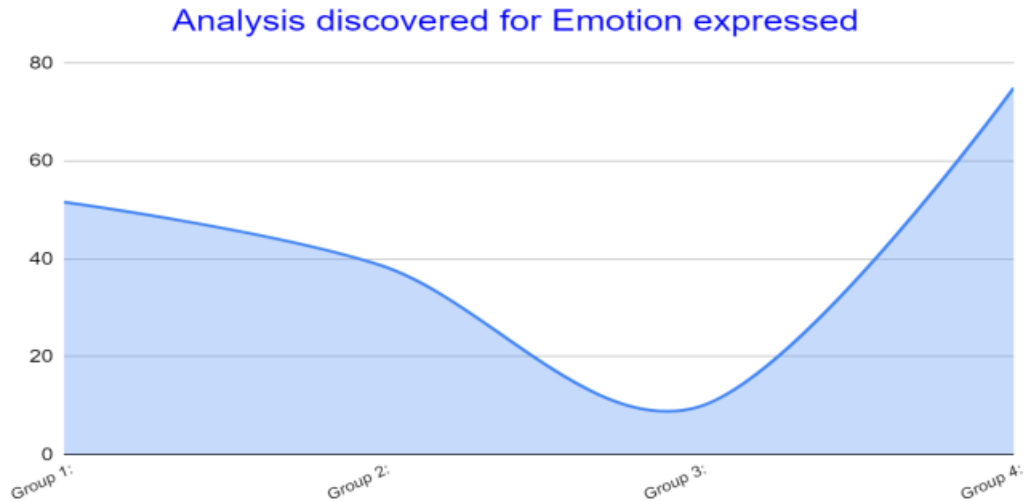


Figure 4: Analysis discover for emotion expressed

After installing the application, all participants in this study received a questionnaire containing 10 questions. To understand the design and functional constraints that led to certain decisions, we included individuals who had never used the application. The collected input was subjected to thematic analysis, which identified four major categories based on frequency of responses.

## V. CONCLUSION

In conclusion, NLP algorithms have been instrumental in training chatbots like these, achieving a prediction accuracy of 77%. These chatbots offer a platform for continuous communication and as AI evolves, distinguishing between a human and a computer program is becoming increasingly challenging. Given the stigma surrounding counselor and student these chatbots provide a supportive space that can make admission issues easier. Chatbots present a low-cost, accessible option for delivering admission guidelines. This study leverages NLP techniques to evaluate the effectiveness of chatbots as a tool for admission process.

The increasing demand for college counseling services has highlighted the limitations of current methods, including longer wait times and restricted access to information during non-business hours. To mitigate these issues, the development of an intelligent chatbot powered by NLP and AI offers a promising solution. This study demonstrated that the chatbot, with voice input capability, effectively addressed frequently asked questions from prospective students, as evidenced by its strong performance in both the Chatbot Usability Questionnaire (CUQ) and Confusion Matrix evaluation. The implementation of such a chatbot could enhance the accessibility and efficiency

of college admissions counseling, ultimately improving the overall experience for prospective students.

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