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Design and Development of A Hybrid AI Chatbot for Improving Administrative Support in Educational Institutions

Pragat V. Gandhi[1], J. R. Mahajan[2], Dr. H. B. Jadhav[3]
[1]Student, Department of Computer Engineering
[2]Guide, Department of Computer Engineering
[3]HOD, Department of Computer Engineering
Adsul's Technical Campus, Chas, Ahmednagar, India

Abstract: *Educational institutions receive many administrative queries related to admissions, fee structures, scholarships, examinations, timetables, and required documents. Answering these queries manually can increase the workload of administrative staff and cause delays for students. This paper proposes a hybrid artificial intelligence (AI) chatbot designed to improve administrative support in educational institutions. The proposed system combines rule-based responses, information retrieval, and generative AI to handle different types of student queries. It aims to provide answers based on verified institutional documents, support common queries in English and selected Indian languages, and identify questions that require human assistance. A confidence-based response mechanism is proposed to reduce incorrect or unsupported answers. The system will be evaluated using response accuracy, response time, query-handling performance, and user feedback. The proposed approach aims to make administrative information more accessible, consistent, and efficient while reducing repetitive work for college staff.*

Keywords: Artificial Intelligence, Hybrid Chatbot, Educational Administration, Natural Language Processing, Information Retrieval, Multilingual Support.

I. INTRODUCTION

Educational institutions handle a large number of administrative queries every day. Students frequently need information about admission procedures, examination schedules, fee payments, scholarships, attendance rules, and required documents. In many colleges, students obtain this information by visiting administrative offices, contacting staff, or checking different websites and notices. These methods can take time, especially when the required information is not easily available. Artificial Intelligence (AI) chatbots provide an alternative way to deliver administrative information. A chatbot allows students to ask questions in natural language and receive responses through a conversation. It can also make basic information available outside regular college working hours. However, the quality of its responses depends on the technology used and the information available to the system. Traditional rule-based chatbots respond according to predefined rules and keywords. They are suitable for common questions but may fail when students ask questions in unfamiliar ways. Retrieval-based chatbots select answers from an existing collection of information, but their performance depends on the quality and coverage of that collection. Generative AI chatbots can produce more flexible responses, although they may sometimes provide incorrect information. These limitations create a need for a system that combines different chatbot approaches [1]. Recent research has explored the use of Retrieval-Augmented Generation (RAG) in educational chatbots. RAG retrieves relevant information from a knowledge source and uses it to generate a response. A 2025 survey reviewed 47 studies on RAG chatbots in education and discussed their applications and evaluation methods [2]. Another study explored an LLM-based educational virtual

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assistant that uses university-related information to answer student queries [3]. These studies indicate the importance of connecting AI-generated responses with relevant information sources. This paper proposes a hybrid AI chatbot for administrative support in Indian educational institutions. The proposed system combines rule-based responses, information retrieval, and generative AI. It is intended to use verified institutional documents as its information source, support English and selected Indian languages, and direct uncertain or sensitive queries to administrative staff. A confidence-based mechanism will help the system decide when it should provide an answer and when human assistance may be necessary.

The proposed system will be evaluated using a prepared set of administrative questions. Its performance will be assessed through answer correctness, response time, query-handling capability, and user feedback. The main aim is to develop a practical approach that can make administrative information easier to access while reducing repetitive work for college staff.

Objectives

The main objectives of the proposed system are:

[1] To combine rule-based responses, information retrieval, and generative AI to handle different types of student questions.

[2] To provide answers using verified institutional documents and reduce the risk of incorrect information.

[3] To explore support for English and a selected Indian language to improve accessibility for students.

[4] To implement a confidence-based mechanism that identifies uncertain queries and forwards them to administrative staff.

[5] To evaluate the proposed system based on answer correctness, response time, query-handling capability, and user feedback.

[6] To design a hybrid AI chatbot that provides quick responses to common administrative queries in educational institutions

II. BACKGROUND AND RELATED WORK

Chatbots are increasingly used in educational institutions to provide quick information and reduce repetitive administrative work. Rule-based chatbots answer questions using predefined rules, while retrieval-based chatbots find relevant information from stored documents. Generative AI chatbots provide flexible responses but may sometimes produce incorrect information. Recent research by Mikael et al. [1] proposed a hybrid chatbot combining rule-based, retrieval-based, and generative approaches for educational administration. Swacha and Gracel [2] reviewed the use of Retrieval-Augmented Generation (RAG) chatbots in education. Other research has explored using RAG and large language models to answer university-related questions using institutional information [3].

Research Gap: Existing approaches show the potential of AI chatbots, but reliable institution-specific answers and the handling of uncertain queries remain important challenges. The proposed system aims to address these challenges by combining multiple chatbot techniques, verified institutional documents, multilingual support, and referral to administrative staff when necessary.

III. PROPOSED SYSTEM

The proposed system is a hybrid AI chatbot designed to provide quick and reliable administrative support to students in educational institutions. It combines rule-based responses, information retrieval, and generative AI to answer queries related to admissions, fees, examinations, scholarships, and academic schedules. When a student submits a query, the system identifies the type of question and selects a suitable response method. Common questions are handled using predefined rules, while institution-specific queries are answered by retrieving relevant information from approved college documents. Generative AI helps prepare clear and understandable responses using the retrieved information.

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The system also proposes multilingual support and a confidence-based mechanism to identify uncertain queries. Questions that cannot be answered reliably are forwarded to administrative staff for assistance. The proposed approach aims to improve information accessibility, reduce repetitive work, and provide students with a convenient way to obtain administrative information.

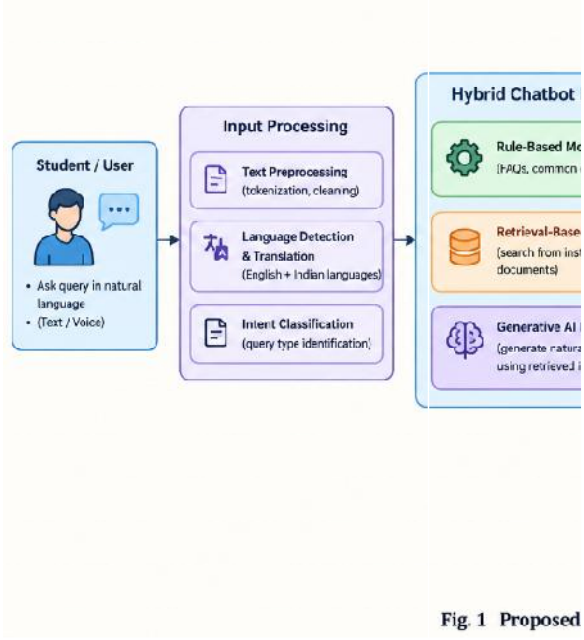


Fig. 1 Proposed

Expert Models

The proposed hybrid chatbot uses three specialized modules to handle different types of student queries.

1. Rule-Based Model: This module answers frequently asked questions using predefined rules and responses, such as college timings, admission dates, and examination schedules.

2. Retrieval-Based Model: This module searches approved college documents, notices, fee structures, and academic guidelines to find relevant information for student queries.

3. Generative AI Model: This module uses retrieved information to generate clear and natural-language answers. It helps handle queries that cannot be answered directly through predefined responses.

The hybrid approach selects a suitable module according to the type of query. This design aims to improve response flexibility while maintaining the reliability of institution-specific information.

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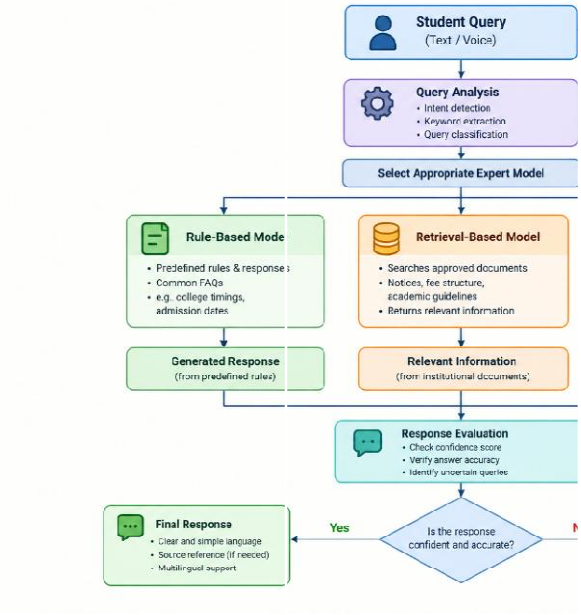


fig. 2 Expert Models

The Rule-Based Model handles common questions using predefined rules and responses. The Retrieval-Based Model searches approved college documents to find relevant information. The Generative AI Model uses retrieved information to generate natural-language responses and handle complex queries. The outputs of these models are passed to the response evaluation module, which checks the confidence score and answer accuracy. If the response is considered reliable, it is provided to the student in clear language. If the response is uncertain or potentially incorrect, the query is forwarded to administrative staff for further assistance.

IV. MODIFICATION OVER EARLIER APPROACH

Traditional chatbots in educational institutions mainly depend on predefined rules or fixed question-answer pairs. Although these systems can answer commonquestions, they often struggle with complex queries and different sentence structures. Generative AI chatbots can provide flexible responses, but they may sometimes generate incorrect or unsupported information. To address these limitations, the proposed system introduces a hybrid approach that combines multiple chatbot technologies. The proposed system combines rule-based, retrieval-based, and generative AI models in a single architecture. Unlike a chatbot that relies on only one response method, the hybrid system selects a suitable model according to the student's query. Common questions, such as college timings and admission dates, can be answered using predefined rules. Queries requiring specific institutional information are handled through document retrieval, while complex questions can be processed using generative AI with relevant information. Another important modification is the integration of verified institutional documents. The system uses official college notices, admission guidelines, fee structures, examination schedules, and scholarship information as knowledge sources. This helps provide answers related to the specific institution instead of depending entirely on the language model's general knowledge. Regular updates to these documents are necessary to maintain the accuracy of the information. The proposed approach also explores multilingual support for English and selected Indian languages. This feature aims to help students communicate in a language they understand comfortably. A confidence-based response mechanism is included to identify questions that cannot be answered reliably. When relevant information is unavailable or the response is uncertain, the chatbot can refer the query to administrative staff rather than provide potentially misleading information. Furthermore, the proposed system includes query analysis to identify the student's intent and select an appropriate response method. Its performance will be evaluated using answer correctness, response time, query-

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handling capability, and user feedback. These evaluations can help determine whether the hybrid approach provides practical benefits over simpler chatbot methods. Overall, the proposed modifications focus on improving flexibility, institution-specific information retrieval, multilingual accessibility, and responsible handling of uncertain queries. These improvements represent the intended design of the system; their effectiveness must be established through experimental testing

Sr. No.	Earlier Approach	Proposed Modification	Expected Benefit
1	Uses predefined rules to answer queries.	Combines rule-based, retrieval-based, and generative AI models.	Handles different types of student queries.
2	Uses fixed answers or limited stored information.	Retrieves information from approved college documents.	Provides institution-specific information.
3	May fail when queries are written differently.	Analyses query intent and important keywords.	Improves query understanding.
4	Generative AI may produce unsupported answers.	Checks response relevance and supporting information.	Aims to reduce incorrect responses.
5	May provide limited language options.	Proposes support for English and selected Indian languages.	Improves accessibility for students.
6	May not have a clear process for unanswered queries.	Refers uncertain queries to administrative staff.	Helps avoid unreliable automated answers.
7	May use limited evaluation measures.	Evaluates correctness, response time, query handling, and user feedback.	Supports systematic performance assessment.
8	Institutional information may become outdated.	Proposes regular verification and updating of documents.	Helps maintain relevant information.

TABLE I. COMPARISON OF METHODOLOGICAL APPROACHES

V. COMPARATIVE ANALYSIS AND DISCUSSION

The proposed hybrid AI chatbot is compared with traditional rule-based chatbots, retrieval-based chatbots, and generative AI-based chatbots. Rule-based chatbots provide predefined answers but may fail to handle queries that are expressed in different ways. Retrieval-based chatbots can provide information from stored documents, but their performance depends on the availability and quality of the information. Generative AI-based chatbots can produce flexible responses; however, they may sometimes generate incorrect or unsupported information.

The proposed system aims to combine the advantages of these approaches. It uses rule-based responses for common queries, retrieval-based methods to obtain information from approved institutional documents, and generative AI to create natural and understandable responses. It also proposes response checking and referral to administrative staff when the system cannot provide a reliable answer. These features are intended to improve the relevance and reliability of administrative support. The proposed system also considers multilingual communication, regular document updates, and performance evaluation based on response correctness, response time, query-handling capability, and user feedback. These features may help make administrative information more accessible to students. However, the actual effectiveness of the system cannot be confirmed without implementation and testing.

Overall, the comparative analysis indicates that the proposed hybrid approach has the potential to address some limitations of individual chatbot methods. Its performance should be evaluated using real student queries and verified institutional information. Future experiments should compare the proposed system with existing approaches to determine whether it provides measurable improvements in accuracy, response time, and user satisfaction.

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VI. LIMITATIONS AND FUTURE SCOPE

The proposed system has several limitations. Its performance will depend on the availability of accurate and updated institutional documents. Missing, outdated, or contradictory information may result in incomplete responses. The quality of generated answers will also depend on the language model and the relevance of retrieved content. Multilingual support may require additional language-processing tools and testing, particularly for regional languages and queries containing mixed-language text. The system may also require technical resources, maintenance, and administrative supervision. Privacy and security must be considered if students submit personal details or if the chatbot accesses restricted institutional information. Future work can focus on implementing a working prototype and evaluating it with real administrative queries. Additional improvements may include better document-update procedures, source-linked answers, stronger uncertainty detection, support for more Indian languages, and integration with authorised college portals. A larger evaluation involving students and administrative staff can help determine whether the system improves response quality and reduces repetitive workload.

VII. CONCLUSION

This paper proposes a hybrid AI chatbot to improve administrative support in educational institutions. The system combines rule-based responses, information retrieval, and generative AI to address student queries related to admissions, fees, examinations, scholarships, and academic schedules. Approved institutional documents are proposed as the main knowledge source for institution-specific answers. The design also includes multilingual support and a mechanism for referring uncertain queries to administrative staff. The proposed approach aims to combine the consistency of predefined responses, the information access provided by retrieval, and the flexibility of generative AI. Its effectiveness must be established through implementation and systematic evaluation using answer correctness, retrieval quality, response time, query-handling capability, and user feedback. The work provides a design framework for developing an administrative chatbot that prioritises relevant institutional information and responsible handling of uncertain questions.

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