

AI-Powered Student Assistant Chatbot for the Department of Technical Education

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Abstract: Students and parents seeking information about technical education frequently depend on websites, telephone calls, emails, and personal visits to obtain admission-related and academic information. These channels can become difficult to manage during admission periods because information is distributed across multiple sources and administrative staff must repeatedly answer similar questions. This paper proposes an AI-powered student assistant chatbot for the Department of Technical Education, Maharashtra, designed as a centralized conversational interface for common student and stakeholder enquiries. The proposed system focuses on admission procedures, eligibility criteria, available institutes and programmes, fee information, scholarships, curriculum, hostel facilities, previous-year allotment information, and placement-related information. A retrieval-oriented architecture is proposed so that responses can be grounded in an approved departmental knowledge base rather than relying only on unrestricted generative output. The methodology combines requirements analysis, knowledge-base preparation, natural-language processing, intent/query understanding, document retrieval, response generation, and human-oriented evaluation. Literature on educational chatbots and admission consultation shows that conversational systems can improve accessibility and response speed, while accuracy, outdated information, hallucination, privacy, multilingual interaction, and evaluation remain important challenges. The proposed framework therefore treats the chatbot as a decision-support and information-access system, with escalation to official human channels for uncertain or sensitive queries. The study provides a practical foundation for developing and evaluating a centralized technical-education information assistant.

Keywords: Artificial Intelligence, Educational Chatbot, Student Assistant, Natural Language Processing, Technical Education, Admission Support, Retrieval-Augmented Generation, Maharashtra

I. INTRODUCTION

The rapid growth of digital services has changed how students search for educational information. Prospective students and their parents increasingly expect information about programmes, eligibility, admission procedures, fees, scholarships, institutes, curriculum, accommodation, and career opportunities to be available quickly and in an understandable form. In technical education, these enquiries can become particularly frequent during admission periods, when applicants may need information at different stages of the application and allotment process. Conventional support through telephone calls, email, websites, and personal visits remains important, but repeated enquiries can increase the workload on administrative personnel and may require students to search across multiple information sources.

Chatbots provide a conversational interface through which users can submit questions using natural language. Earlier educational chatbots were often designed around predefined intents, frequently asked questions, keywords, or rule-based responses. More recent systems use machine learning, natural-language processing, transformer models, and retrieval-augmented generation (RAG) to retrieve relevant information and produce contextual responses. Systematic reviews indicate that educational chatbots have been explored for teaching assistance, mentoring, information access, and student support, but evaluation methods and real-world deployment practices remain inconsistent [1][3].

Admission-oriented research is especially relevant to the proposed problem. Chen et al. investigated university admission consultation using ChatGPT 3.5 combined with retrieval-augmented generation and reported substantially higher answer accuracy for the retrieval-based system than for the base model [4]. Earlier work on university admission enquiry systems also demonstrated the usefulness of chatbot-based rapid responses for frequently repeated admission questions [5]. These studies suggest that a specialized knowledge source is important when the chatbot must provide institution-specific information rather than general educational conversation.

The motivation of this research is therefore to design a centralized AI-powered student assistant specifically for the Department of Technical Education, Maharashtra. The proposed system is intended to reduce repetitive information requests, improve accessibility to official information, and provide a consistent first level of assistance. The research does not position the chatbot as a replacement for authorized officials. Instead, it is designed as an information-access and decision-support layer that can direct users to official sources or human assistance when the requested information is uncertain, sensitive, or outside the knowledge base.

II. LITERATURE REVIEW

Wollny et al., in (2021) [1], conducted a systematic literature review on chatbots in education and examined 74 relevant publications from an initial set of 2,678 records. The review identified applications such as teaching assistance, mentoring, information access, and student support, while also highlighting challenges related to evaluation, implementation, and adaptation. The study establishes the broader educational relevance of chatbot-based assistance.

Okonkwo and Ade-Ibijola, in (2021) [2], reviewed 53 studies on chatbot applications in education. Their findings indicated that chatbots can provide quick and personalized services to learners and institutions, while also identifying limitations concerning technology, implementation, and user acceptance. The study supports the use of conversational systems for routine educational information services.

Labadze et al., in (2023) [3], presented a systematic literature review of AI chatbots in education based on 67 studies. The authors reported applications in learning support, homework assistance, personalized learning, and skill development, while discussing limitations and responsible-use concerns. Their findings indicate that AI chatbots can support educational processes when their use is appropriately designed and monitored.

Chen et al., in (2024) [4], investigated university admission consultation using a chatbot based on ChatGPT 3.5 and retrieval-augmented generation (RAG). The study combined language-model generation with retrieved institutional information and evaluated the system using admission-related questions from high-school students. The reported results showed a substantial improvement in answer accuracy when retrieval-based support was used, demonstrating the relevance of RAG for admission information services.

Gbenga et al., in (2020) [5], proposed an improved rapid-response model for a university admission enquiry system using an IBM Watson chatbot. The system was designed to answer frequently repeated admission questions and was evaluated using Botium-based testing. The reported evaluation demonstrated that chatbot-based enquiry support can provide rapid responses for routine admission information.

McGrath et al., in (2025) [6], reviewed the emerging research area of generative AI chatbots in higher education. Their review of empirical studies highlighted the rapid development of generative-AI applications while also noting differences in conceptual approaches, research purposes, and evaluation practices. The study emphasizes the need for clearer frameworks and evidence when deploying generative chatbots in educational settings.

Albadarin et al., in (2024) [7], conducted a systematic literature review of empirical research on ChatGPT in education. The study examined empirical evidence concerning the use, benefits, limitations, and educational implications of ChatGPT. The findings reinforce the importance of evaluating accuracy, responsible use, and the specific educational context when conversational AI is applied.

Yusuf et al., in (2024) [8], mapped 407 publications concerning generative AI in education and research. The review identified major themes including applications and impacts, adoption, performance, and ethical implications and risks. The study demonstrates the rapid expansion of generative-AI research and the need to consider both technical effectiveness and responsible implementation.

Aloqayli and Abdelhafez, in (2023) [9], developed an intelligent chatbot for admission support in higher education. The system was evaluated through interactions with postgraduate students and focused on improving access to admission information and reducing dependence on staff availability. The study demonstrates the practical use of conversational agents for higher-education admission enquiries.

Nguyen and Quan, in (2025) [10], proposed URAG, a unified hybrid retrieval-augmented generation framework for university admission chatbots. The approach combines retrieval mechanisms to improve the factual precision of admission-related answers and addresses the need for reliable information in university consultation. The work is relevant to the proposed system because it emphasizes grounded responses rather than unrestricted generation.

Nguyen et al., in (2025) [11], presented an efficient chatbot for university admission consultation using large language models, semantic retrieval, vector similarity, keyword matching, and RAG. The system was developed using

admission FAQs, official documents, and consultation records. Their approach indicates that combining semantic and lexical retrieval can improve the relevance of information supplied by an admission chatbot.

Bettayeb et al., in (2024) [12], reviewed the impact of ChatGPT and conversational AI in education. The study discussed the potential of conversational AI to support learning and educational interaction while also identifying concerns involving accuracy, ethics, dependence, and responsible use. These findings are relevant to designing a technical-education assistant with verification and human escalation mechanisms.

The reviewed studies collectively show a progression from rule-based and FAQ-oriented educational chatbots toward machine-learning, large-language-model, and retrieval-augmented systems. However, much of the existing admission-focused work is centered on a single university or institution. A comparatively less explored area is a centralized, state-level technical-education assistant serving multiple institutes and information categories while supporting verified, updateable, and potentially multilingual information. This gap motivates the proposed AI-powered student assistant for the Department of Technical Education, Maharashtra.

III. RESEARCH METHODOLOGY

The study follows an applied research and prototype-development approach. The methodology is designed to translate recurring technical-education information needs into a controlled conversational information system. The overall process consists of requirements identification, knowledge-source preparation, query processing, information retrieval, response generation, interface development, and evaluation.

A. Requirements Identification: The initial requirement analysis defines the major categories of questions expected from students, parents, and other stakeholders. These include admission procedure, eligibility, institute and programme information, fee structure, scholarships, curriculum, hostel facilities, previous-year allotment information, placement information, important dates, and links to official services. The categories can be refined after reviewing actual departmental documents and representative user questions.

B. Knowledge-Base Preparation: The chatbot should use approved departmental documents, official notifications, programme information, institute details, scholarship information, and other authorized sources. Documents are converted into searchable text, cleaned, divided into meaningful passages, and indexed. Each information item should retain source metadata such as document name, section, publication/update date, and URL where applicable. This enables later verification and updating.

C. Query Understanding and Retrieval: A user query is first normalized and analyzed to identify its information need. Relevant keywords, entities, and semantic meaning are used to retrieve candidate passages from the knowledge base. A hybrid approach combining keyword retrieval with semantic similarity is suitable because some technical-education queries contain exact terms such as programme names, fees, dates, or institute codes, while others may be phrased conversationally. Retrieved passages are then provided as context to the response-generation component.

D. Response Generation and Grounding: The response component generates a concise answer from retrieved evidence. The system should be instructed not to invent missing facts and should indicate when the available knowledge is insufficient. For time-sensitive information, the answer should identify the relevant official notice or direct the user to the current official source. Sensitive or case-specific matters should be escalated to the responsible department or authorized officer.

E. User Interface and Interaction: The proposed interface consists of a simple conversational window accessible through a web-based application. Users can enter questions in natural language and receive responses without navigating through multiple pages. Frequently requested categories may also be provided as quick options. A feedback mechanism can allow users to mark whether an answer was useful and report an incorrect or outdated response.

F. Evaluation Method: Evaluation should use a representative test set of questions covering all major information categories. Core measures include answer accuracy, retrieval relevance, response time, successful query resolution, fallback rate, and user satisfaction. Where labelled test questions are available, precision, recall, and F1-score can be used for intent classification. For generated answers, factual correctness and source-grounding should be assessed separately by human evaluators. The evaluation should be conducted only after the prototype and dataset are finalized; numerical performance values should not be assumed in advance.

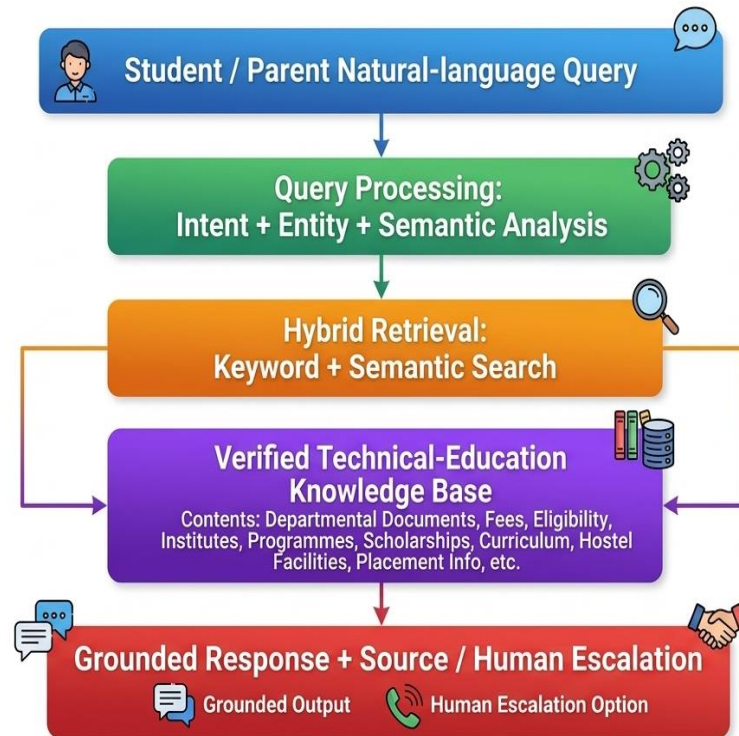


Fig. 1. Proposed architecture of the AI-powered student assistant chatbot.

Department of Technical Education Student Assistant Chatbot: Key Functional Modules

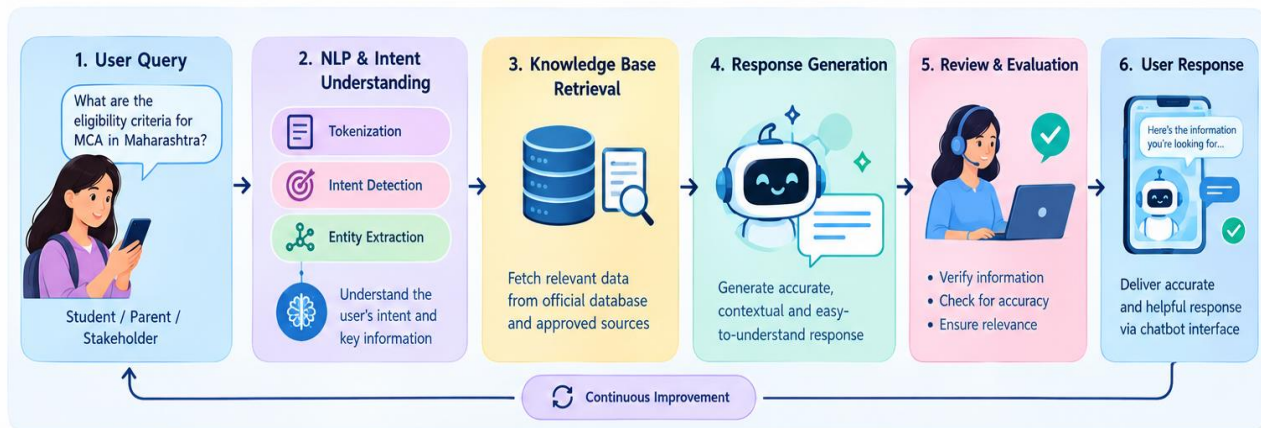


IV. RESULTS

The present research proposes a system architecture and evaluation methodology rather than claiming unperformed experimental results. Following the approach visible in the supplied publication sample, numerical values are not assumed before the prototype is tested. The intended result is a measurable evaluation of whether the proposed assistant can provide accurate, relevant, timely, and source-grounded information for common technical-education enquiries.

Table I : summarizes the principal evaluation measures proposed for the system.

Evaluation Aspect	Measure / Output	Purpose
Answer Accuracy	Human-verified correct answers (%)	Factual reliability
Retrieval Relevance	Relevant retrieved passages	Knowledge grounding
Response Time	Average query-to-answer time	Responsiveness
Resolution Rate	Queries resolved without escalation (%)	Service effectiveness
Fallback Rate	Correctly escalated/declined queries (%)	Safety and reliability
User Satisfaction	Post-interaction rating	Usability and acceptance



V. DISCUSSION

The literature supports the use of conversational systems for reducing friction in educational information access, but it also shows that chatbot usefulness depends strongly on context, evaluation, and information quality [1]–[3]. For a technical-education assistant, the central challenge is not simply generating fluent language. The system must provide information that is relevant to the user's question and consistent with current official records.

Retrieval-augmented generation is particularly suitable for this setting because it can connect conversational interaction with a controlled information repository. Admission consultation research has demonstrated the potential accuracy gains of retrieval-grounded approaches over general-purpose model responses [4]. At the same time, recent research continues to identify hallucination, outdated information, and the difficulty of maintaining trustworthy AI outputs as practical concerns [6], [10], [11]. Therefore, source grounding and explicit fallback behavior should be treated as core design requirements rather than optional enhancements.

Another important consideration is multilingual and accessible interaction. Maharashtra has a diverse student population, and users may express questions in English, Marathi, Hindi, or mixed language. A future version of the system can incorporate multilingual query understanding and responses while maintaining a single controlled knowledge base. However, multilingual support should be evaluated separately because translation and semantic interpretation can introduce additional errors.

The system also needs an update mechanism. A chatbot can become unreliable if its knowledge base contains old admission dates, outdated fees, discontinued programmes, or superseded notices. Every indexed document should therefore have source and update metadata, and an administrative process should be defined for replacing outdated information. Human escalation remains necessary for exceptional cases, individual application problems, legal or policy interpretation, and questions not supported by the available documents.

The proposed system should consequently be understood as an intelligent first-level information assistant. It can reduce repetitive enquiries and make official information easier to access, but it should not independently make administrative decisions, guarantee admission outcomes, or replace authorized departmental communication.

VI. CONCLUSION

This paper presented a proposed AI-powered student assistant chatbot for the Department of Technical Education, Maharashtra. The research was motivated by the repeated need for accessible information concerning admissions, eligibility, institutes, programmes, fees, scholarships, curriculum, hostels, allotment information, placements, and related student services. A retrieval-grounded conversational architecture was proposed to connect natural-language questions with an approved technical-education knowledge base.

The literature review shows that educational chatbots have developed from rule-based and FAQ systems toward machine-learning, transformer, and retrieval-augmented approaches. Existing studies demonstrate potential benefits in accessibility and response speed, while also identifying challenges involving accuracy, evaluation, ethical concerns, over-reliance, and changing information [1]–[8]. Admission-specific research further indicates that grounding responses in institutional data can substantially improve factual performance [4], [10], [11].

The proposed system provides a practical foundation for future implementation. Its main contribution is the integration of domain-specific technical-education information, retrieval-grounded responses, updateable knowledge sources, feedback, and human escalation within one student-facing assistant. Future work should implement the prototype, construct a verified Maharashtra technical-education dataset, evaluate accuracy and usability with representative users, examine multilingual interaction, and measure performance against clearly defined service objectives.

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