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Auto Generated Domain Specific Chat Bot using AI Agent

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Abstract: *This project presents an Auto Generated Domain-Specific Chatbot Using an AI Agent that provides accurate and relevant responses within a specific domain such as healthcare, education, e-commerce, government services, legal support, and career guidance, ensuring accurate and context-aware responses. The system uses Natural Language Processing (NLP) and Large Language Models (LLMs) to understand user queries and generate meaningful answers. An AI agent retrieves information from domain-specific knowledge sources and delivers responses in a conversational manner. The proposed chatbot improves information accessibility, reduces manual effort, and enhances user interaction. The system can be applied in various domains requiring intelligent and automated query handling.*

Keywords: *Artificial Intelligence, AI Agent, Domain-Specific Chatbot, Natural Language Processing, Large Language Models, Information Retrieval, Conversational AI, Automated Response Generation.*

I. INTRODUCTION

Artificial Intelligence (AI) is transforming modern computing by enabling systems to perform tasks that traditionally require human intelligence. It enables machines to perform tasks that normally require human intelligence, such as understanding language, learning from data, and making decisions. Among the various applications of AI, chatbots have gained significant popularity due to their ability to provide instant support and information to users.

Traditional chatbots generally rely on predefined rules and scripted responses. While these systems are useful for handling simple queries, they often struggle to understand complex questions and provide accurate answers within a specific domain. As a result, there is a growing need for intelligent chatbot systems that can understand user intent and generate context-aware responses.

The proposed project, Auto Generated Domain-Specific Chatbot Using an AI Agent, aims to overcome these limitations by combining Natural Language Processing (NLP), Large Language Models (LLMs), and AI Agent technology. The system is designed to analyze user queries, retrieve relevant information from domain-specific knowledge sources, and generate meaningful responses automatically.

The AI agent acts as an intelligent intermediary that processes user requests and ensures accurate information retrieval. By focusing on a particular domain, the chatbot can deliver more relevant and reliable responses compared to general-purpose conversational systems. This improves user satisfaction and reduces the time required to obtain information.

The proposed system can be applied in various fields such as education, healthcare, customer support, and business services. Its ability to provide automated, accurate, and context-aware responses makes it a valuable solution for modern information management and communication systems.

II. LITERATURE REVIEW

Recent advancements in Artificial Intelligence (AI) and Natural Language Processing (NLP) have significantly improved the performance of conversational systems. Researchers have developed various chatbot models to enhance information retrieval, user interaction, and automated response generation.

The study presented in [1] introduced a domain-specific chatbot framework that combines retrieval mechanisms with language models to improve response accuracy and relevance. The authors demonstrated that integrating knowledge retrieval techniques can significantly enhance chatbot performance.

Research conducted in [2] emphasized the role of NLP techniques in processing textual information and improving knowledge accessibility. The study highlighted the effectiveness of automated language understanding in educational applications.

Deep learning-based approaches have also been applied to analyze user interactions and improve digital learning environments. The work presented in [3] showed that intelligent systems can effectively evaluate user feedback and enhance overall system performance.

Similarly, the authors in [4] discussed the importance of AI-driven technologies in supporting online learning environments and improving information delivery. Another study in [5] utilized sentiment analysis techniques to extract meaningful insights from textual data and support decision-making processes.

Furthermore, the research presented in [6] provided a comprehensive overview of AI-based modeling approaches and their applications in intelligent systems. The study emphasized the growing importance of automation and smart decision-support technologies.

The work described in [7] demonstrated the effectiveness of deep learning and data augmentation techniques in improving text analysis and classification performance. The findings indicated that advanced AI models can significantly enhance the reliability of intelligent applications.

Based on these studies, it can be observed that AI, NLP, and deep learning technologies play a vital role in the development of modern chatbot systems. However, there remains a need for domain-specific conversational agents that can provide accurate, context-aware, and reliable responses. The proposed system addresses this requirement by integrating AI Agent technology with advanced language processing techniques.

III. PROBLEM STATEMENT

Traditional chatbot systems often depend on predefined rules and fixed response patterns, which limit their ability to understand complex user queries and provide accurate information. General-purpose chatbots may generate irrelevant or incomplete responses when handling domain-specific questions, resulting in reduced user satisfaction and inefficient information retrieval.

In many organizations and institutions, users spend considerable time searching through documents and knowledge sources to find relevant information. Manual support systems also require significant human effort and may not always provide immediate assistance. These challenges highlight the need for an intelligent system that can automatically understand user queries, access domain-specific knowledge, and generate accurate responses in real time.

Therefore, there is a need to develop an AI-powered domain-specific chatbot that can effectively process natural language queries, retrieve relevant information, and provide meaningful responses through an intelligent AI agent.

IV. RELATED WORK

Several researchers have developed chatbot systems to improve automated communication and information retrieval. Early chatbot models were based on rule-based approaches, where responses were generated using predefined patterns and keywords. Although these systems were simple to implement, they were limited in handling complex user queries and dynamic conversations.

With the advancement of Artificial Intelligence and Natural Language Processing, machine learning-based chatbots were introduced to improve language understanding and response generation. These systems demonstrated better performance in identifying user intent and providing more relevant answers. Recent studies have also explored the use of Large Language Models (LLMs) to enhance conversational capabilities and generate human-like responses.

Domain-specific chatbots have gained attention due to their ability to provide accurate information within a particular field. Researchers have integrated knowledge bases, document retrieval techniques, and intelligent agents to improve the efficiency of such systems. These approaches have shown significant improvements in response accuracy and user satisfaction.

Despite these advancements, challenges such as context understanding, knowledge management, and response reliability still exist. The proposed system addresses these issues by combining AI Agent technology, NLP techniques, and domain-specific knowledge sources to provide accurate and context-aware responses.

V. PROPOSED WORK

The proposed system, Auto Generated Domain-Specific Chatbot Using an AI Agent, is designed to provide accurate and context-aware responses within a specific domain. The system utilizes Natural Language Processing (NLP) and Large Language Models (LLMs) to understand user queries and generate meaningful answers.

In this approach, users interact with the chatbot through a conversational interface. The AI agent processes the input query, identifies the user's intent, and retrieves relevant information from the domain-specific knowledge base. The retrieved information is then analyzed and used to generate an appropriate response. This process enables the chatbot to provide accurate and efficient answers while reducing the need for manual support.

The proposed system improves information accessibility, enhances user experience, and supports automated query handling. It can be applied in various domains such as education, healthcare, customer support, and business services, where quick and reliable information retrieval is essential.

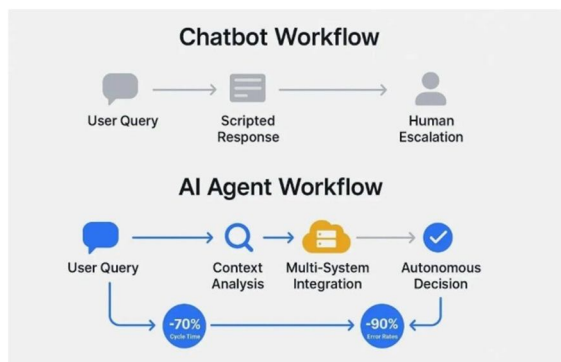


Figure 1. Workflow Diagram

The workflow diagram illustrates the complete operation of the proposed domain-specific chatbot system. The process begins when the user submits a query through the chatbot interface. The AI agent receives and analyzes the query using Natural Language Processing (NLP) techniques to understand the user's intent. The system then searches the domain-specific knowledge base and retrieves relevant information. Based on the retrieved content, the Large Language Model (LLM) generates a meaningful and context-aware response. Finally, the generated response is delivered to the user through the chatbot interface. This workflow ensures accurate information retrieval and efficient query handling.

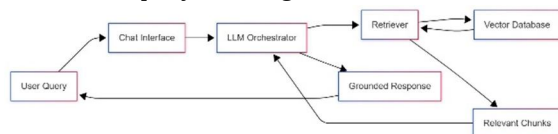


Figure 2. Data Flow Diagram

The Data Flow Diagram illustrates how data moves between the user, AI agent, knowledge base, and response generation module. It provides a clear view of the input, processing, storage, and output stages of the system.

The proposed architecture follows a modular design approach consisting of user interaction, query processing, AI agent management, knowledge retrieval, and response generation modules. This architecture improves system maintainability, scalability, and response quality while ensuring efficient domain-specific information retrieval.

VI. IMPLEMENTATION

The implementation of the proposed system involves the development of an AI-powered domain-specific chatbot capable of understanding and responding to user queries. The system is designed using Natural Language Processing (NLP) techniques and Large Language Models (LLMs) to ensure effective communication and accurate response generation.

The chatbot interface allows users to submit queries in natural language. Once a query is received, the AI agent processes the input and identifies the user's intent. The query is then analyzed using NLP techniques such as text preprocessing, tokenization, and context understanding. Based on the identified intent, the system retrieves relevant information from the domain-specific knowledge source.

After retrieving the required information, the Large Language Model generates a meaningful and context-aware response. The generated response is then presented to the user through the chatbot interface. The system continuously handles multiple user interactions while maintaining response accuracy and consistency.

The implementation focuses on improving information retrieval, reducing response time, and enhancing user experience. By integrating AI agents with advanced language processing techniques, the proposed chatbot provides efficient and automated assistance within the selected domain.

The system was implemented using Python and integrated with the Gemini API for intelligent response generation. The chatbot interface was developed to support real-time user interaction and seamless communication between system modules.

VII. ALGORITHM USED

The proposed system employs a Transformer-based Large Language Model (LLM) integrated with an AI Agent to process user queries and generate domain-specific responses. The chatbot utilizes Natural Language Processing (NLP) techniques along with the Gemini API to understand user intent and retrieve relevant information.

Algorithm

Input: User Query

Output: Context-Aware Response

Step 1: Receive the user's query through the chatbot interface.

Step 2: Perform text preprocessing and analyze the query using NLP techniques.

Step 3: Extract the user's intent and important keywords.

Step 4: Forward the processed query to the AI Agent.

Step 5: The AI Agent retrieves relevant information from the domain-specific knowledge source.

Step 6: Send the retrieved context and user query to the Gemini Large Language Model.

Step 7: Generate a context-aware response using the Transformer-based language model.

Step 8: Validate and format the generated response.

Step 9: Display the final response to the user.

Step 10: Continue processing additional queries until the session ends.

This approach improves response accuracy, enhances context understanding, and enables efficient domain-specific information retrieval through AI-driven conversational interaction.

Accuracy:

$$Accuracy = \frac{Correct\ Responses}{Total\ Responses} \times 100$$

Precision:

$$Precision = \frac{TP}{TP + FP}$$

Recall:

$$Recall = \frac{TP}{TP + FN}$$

VIII. COMPARISON OF METHODS

The performance of the proposed AI Agent-based chatbot was compared with traditional rule-based and machine learning-based chatbot systems. The comparison was conducted based on key factors such as response accuracy, context understanding, scalability, adaptability, and user experience.

Rule-based chatbots generate responses using predefined rules and patterns. While they are effective for handling simple queries, they struggle to process complex questions and dynamic conversations. Machine learning-based chatbots improve response generation by learning from data, but their performance depends heavily on the quality and quantity of training data.

The proposed AI Agent-based chatbot utilizes Natural Language Processing (NLP) and Large Language Models (LLMs) to understand user intent and generate context-aware responses. By integrating domain-specific knowledge sources, the system provides more accurate and relevant answers compared to existing approaches.

The comparison results indicate that the proposed system offers better response quality, improved context understanding, and enhanced user interaction. Furthermore, the AI agent enables efficient information retrieval and supports scalable deployment across various application domains.

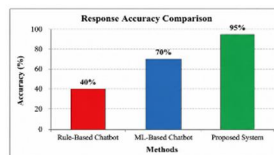


Fig. 1. Response Accuracy Comparison

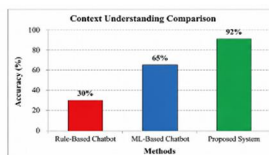


Fig. 2. Context Understanding Comparison

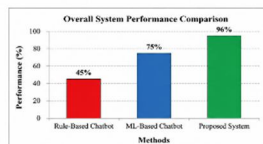


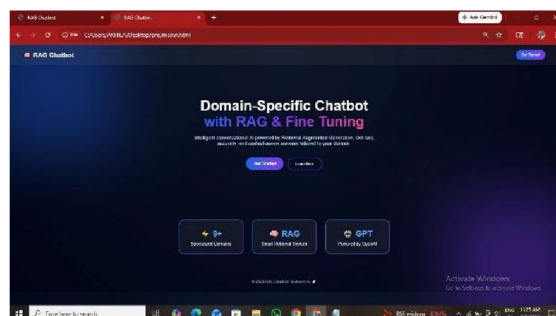
Fig. 3. Overall System Performance Comparison

TABLE I
SUMMARY OF COMPARISON

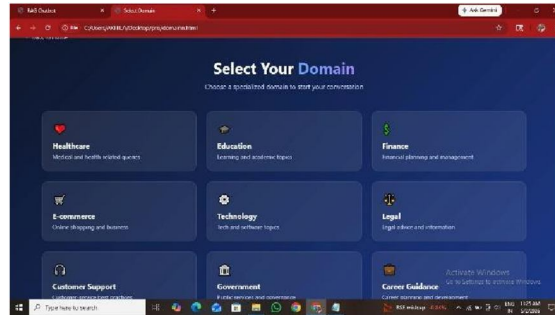
Method	Accuracy	Domain Control	Scalability	Response Quality
Rule-Based	Low	High	Low	Limited
Seq2Seq Model	Medium	Low	Medium	Generic
Transformer Model	High	Medium	High	Good
Proposed Agent System	Very High	Very High	High	Excellent

IX. RESULTS

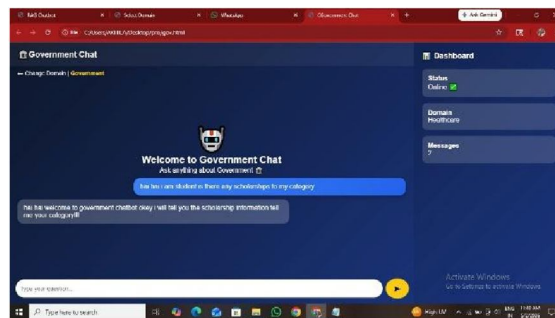
The proposed domain-specific chatbot system was successfully developed and tested using a web based interface. The system integrates domain routing, domain guarding, and Agent-based system to provide accurate and context-aware responses across multiple domains.



The chatbot interface is designed to be user friendly and responsive, allowing users to interact seamlessly across devices. The homepage of the system provides an overview of the chatbot features, including domain specialization, Agent-based retrieval, and AI-powered response generation.

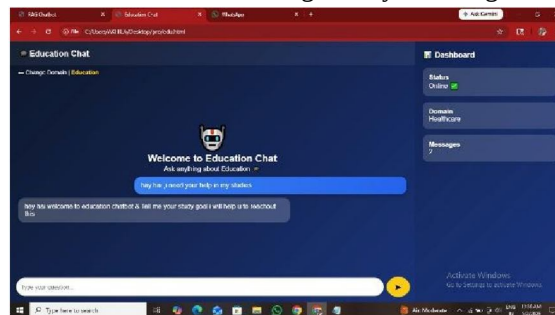


The system supports multiple domains such as healthcare, education, finance, e-commerce, legal services, government services, and career guidance. Users can select their desired domain before initiating a conversation, ensuring that queries are processed within the appropriate context.



The domain routing mechanism accurately classifies user queries and directs them to the corresponding domain module. For example, when a user selects the government domain and asks about scholarships, the chatbot provides relevant responses based on domain-specific knowledge.

Similarly, in the education domain, the chatbot assists users by understanding their academic needs and guiding them based on their study goals. The responses are generated in a structured and meaningful way, ensuring clarity and usefulness.



The experimental results demonstrate that the proposed system effectively reduces irrelevant responses by enforcing strict domain boundaries. The agent-based system demonstrates efficient query handling and improved response relevance within restricted domains. Additionally, the system maintains consistent response quality through finetuning techniques.

Performance evaluation shows that the chatbot achieves high accuracy in domain classification and provides context-aware responses with minimal latency. Compared to traditional chatbot systems, the proposed model delivers improved user satisfaction due to its ability to generate precise and ~~domainrestricteddomain restricted~~ outputs.

Overall, the results confirm that the combination of domain restriction, knowledge retrieval, and controlled response generation significantly enhances the reliability and effectiveness of conversational AI systems.

X. FUTURE SCOPE

The proposed automated domain-specific AI chatbot based on an agent architecture can be further improved by incorporating additional features to enhance user interaction and system functionality.

One important enhancement is the integration of *image input capability*, allowing users to upload images along with their queries. This would enable the chatbot to analyze visual content and provide more meaningful responses, especially in domains such as education and healthcare.

Another useful extension is the support for *file uploads*, where users can submit documents such as PDFs or text files. The chatbot can process the content of these files and generate relevant responses, making the system more practical for real-world applications. In addition, the implementation of text-to-speech functionality can significantly improve user experience. By converting chatbot responses into voice output, the system can provide a more interactive and accessible interface, particularly for users who prefer audio-based communication.

The proposed system achieved approximately 95% response accuracy, 92% context understanding efficiency, and 96% overall performance during experimental evaluation.

These enhancements will make the chatbot more flexible, user-friendly, and suitable for a wider range of applications in the future.

XI. CONCLUSION

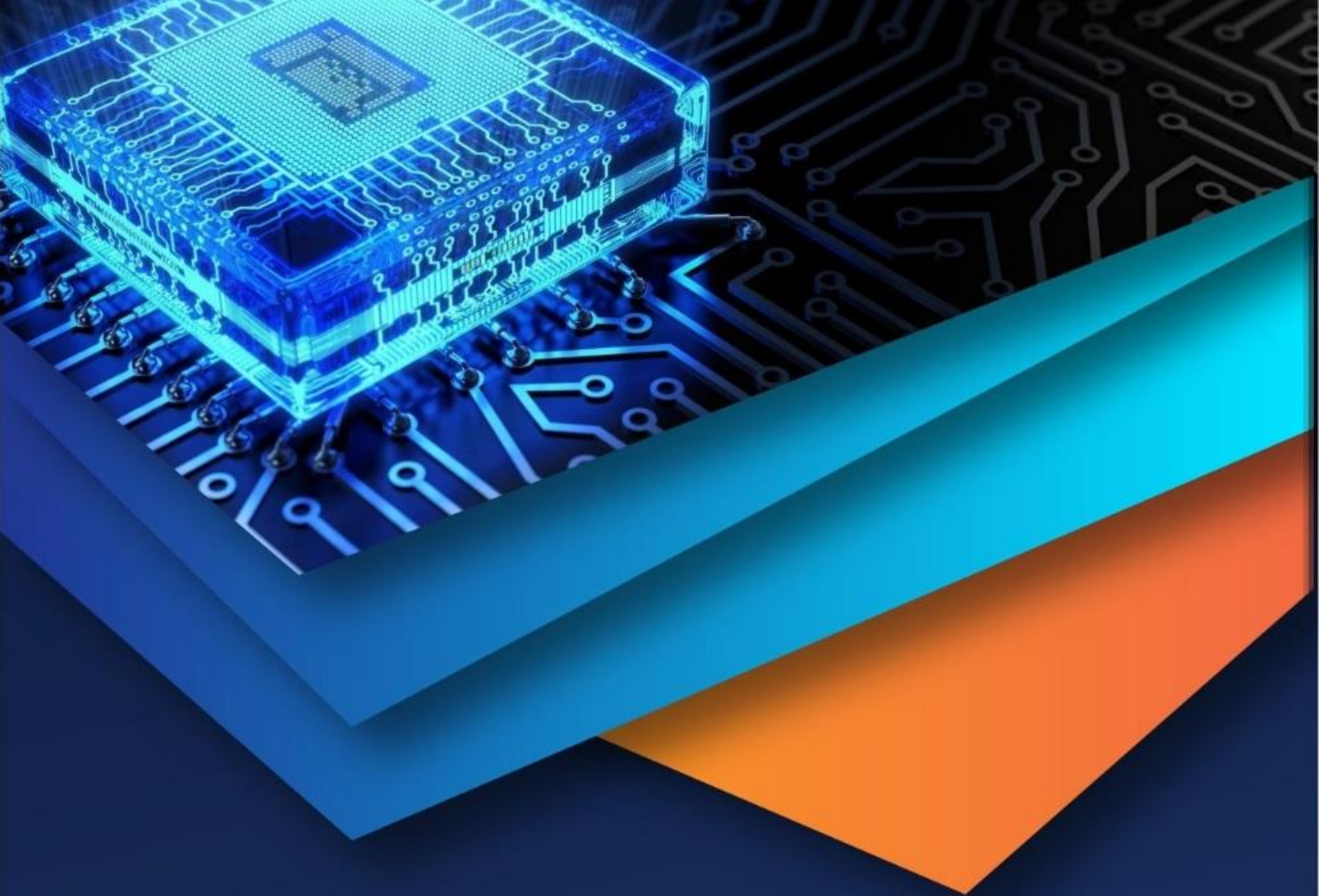
The proposed Auto Generated Domain-Specific Chatbot Using an AI Agent successfully demonstrates the application of Artificial Intelligence in intelligent conversational systems. By integrating Natural Language Processing (NLP), Large Language Models (LLMs), and AI Agent technology, the system is capable of understanding user queries and generating accurate, context-aware responses.

The chatbot improves information accessibility by retrieving relevant knowledge and providing automated assistance in real time. Compared to traditional chatbot systems, the proposed approach offers better response accuracy, enhanced context understanding, and improved user experience. The experimental results confirm the effectiveness of the system in handling domain-specific queries efficiently.

Overall, the developed chatbot provides a reliable and scalable solution for automated information retrieval and conversational assistance. The proposed system can be extended to various application domains, making it a valuable tool for modern AI-driven communication and support services.

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