



Development of AI Driven Chatbot for Ingres as a Virtual Assistant

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KEYWORDS

ABSTRACT

AI-driven chatbots and virtual assistants have revolutionized human-computer interaction across various industries, including customer service, healthcare, e-commerce, and finance. These intelligent systems leverage natural language processing (NLP), machine learning (ML), and deep learning techniques to understand user intent, provide personalized responses, and automate routine tasks. Recent advancements in AI have significantly enhanced chatbot capabilities, enabling more human-like conversations and improved decision-making. Despite their growing adoption, challenges such as data privacy concerns, ethical considerations, and limitations in contextual understanding remain. This paper explores the evolution, applications, benefits, and challenges of AI-driven chatbots and virtual assistants, highlighting their impact on business efficiency and user experience. Furthermore, it discusses future trends in AI development, emphasizing the role of large language models and multimodal interactions in shaping the next generation of virtual assistants

1. INTRODUCTION

The development of an AI-driven chatbot for INGRES as a virtual assistant aims to enhance user interaction by providing instant, accurate, and automated responses to queries. With the rapid growth of digital communication, organizations require intelligent systems that can handle large volumes of user requests efficiently. This chatbot leverages artificial intelligence and natural language processing to

understand user inputs and deliver relevant information. It helps reduce human workload while improving response time and service quality. The system is designed to be user-friendly, scalable, and capable of continuous learning.

In addition, the chatbot is developed to support multiple functionalities such as answering frequently asked questions, guiding users through services, and assisting with real-time problem-solving.

It integrates modern technologies including machine learning algorithms and backend frameworks to ensure smooth operation and reliability. The system can adapt to user behavior and improve its responses over time through training and feedback. By implementing this AI-driven solution, INGRES can achieve better customer engagement and operational efficiency. Overall, the chatbot serves as a smart virtual assistant that enhances the overall user experience.

1.1. Background of Career Guidance Systems:

Career guidance systems have evolved to help individuals choose suitable education and career paths based on their interests, skills, and goals. Traditional systems relied on manual counseling, which was time-consuming and limited in accessibility. With the advancement of artificial intelligence, modern systems like AI-driven chatbots provide instant, personalized guidance and support. In the development of an AI-driven chatbot for INGRES, this background helps in delivering efficient, scalable, and user-friendly career assistance.

a) Traditional Counseling Limitations

Traditional counseling methods have several limitations, including limited availability of counselors and restricted access for users in remote areas. They are often time-consuming and cannot handle a large number of queries simultaneously. These challenges highlight the need for AI-driven chatbots that provide instant, scalable, and 24/7 support.

b) Increasing Student Confusion in Career Selection

Increasing student confusion in career selection is a major challenge due to the wide range of educational options and career paths available today. Many students lack proper guidance and reliable information, which makes decision-making difficult and stressful. This highlights the need for an AI-driven chatbot that can provide clear, personalized, and timely career guidance.

c) Digital Transformation in Education

The integration of digital technologies in education has enabled data-driven learning and personalized student experiences. Advanced tools such as artificial intelligence and machine learning allow effective

analysis of student data to support informed decision-making. This digital shift creates opportunities for intelligent career guidance systems that are adaptive, scalable, and accessible.

1.2. Problem Statement:

The problem addressed in the development of an AI-driven chatbot for INGRES as a virtual assistant is the lack of efficient, accessible, and personalized support for user queries and career guidance. Traditional systems are often time-consuming, limited in availability, and unable to handle multiple users simultaneously. This leads to delays, confusion, and reduced user satisfaction. Therefore, there is a need for an intelligent system that can provide instant, accurate, and scalable assistance.

a) Lack of Personalization

Lack of personalization is a major issue in traditional systems, where users receive generic responses that may not match their individual needs or preferences. This reduces the effectiveness of guidance and user satisfaction. An AI-driven chatbot addresses this by providing customized responses based on user data and behavior.

b) Generic Recommendations

Generic recommendations in traditional systems often provide the same advice to all users without considering their individual interests, skills, or goals. This can lead to irrelevant guidance and confusion in decision-making. An AI-driven chatbot overcomes this by analyzing user inputs and delivering personalized and meaningful recommendations.

c) Absence of Data-Driven Decision Support

The absence of data-driven decision support in traditional systems limits the ability to provide accurate and reliable guidance. Decisions are often based on general assumptions rather than real user data and trends. An AI-driven chatbot addresses this issue by using data analytics and machine learning to deliver informed and effective recommendations.

d) Guidance Gap for Rural and Tier-3 Students

There is a significant guidance gap for rural and tier-3 students due to limited access to career

counseling resources and expert support. Many students do not receive timely or accurate information, which affects their career decisions. An AI-driven chatbot helps bridge this gap by providing accessible, affordable, and 24/7 guidance to all users regardless of location.

1.3. Need for AI-Based Career Advisory System:

There is a growing need for an AI-based career advisory system to provide accurate, personalized, and instant guidance to students. Traditional methods are limited in scalability and cannot meet the increasing demand for career support. An AI-driven chatbot addresses this need by offering intelligent, data-driven recommendations and continuous assistance anytime, anywhere.

a) Data-Based Prediction Importance

Data-based prediction plays a vital role in developing an AI-driven chatbot for INGRES as a virtual assistant. It helps analyze user data, trends, and patterns to provide accurate and personalized career recommendations. This improves decision-making, enhances user experience, and increases the overall effectiveness of the chatbot system.*

b) Skill-Gap Identification

Skill-gap identification is an important feature in developing an AI-driven chatbot for INGRES as a virtual assistant. It helps analyze a user's current skills and compare them with industry requirements to identify missing competencies. This enables the chatbot to provide targeted suggestions for skill improvement and career growth.

c) Emerging Career Domains

Emerging career domains are rapidly evolving due to advancements in technology and changing industry demands. Fields such as artificial intelligence, data science, cybersecurity, and digital marketing offer new opportunities for students. An AI-driven chatbot helps users stay updated and provides guidance on choosing suitable careers in these growing domains.

d) Reducing Career Decision Anxiety

Reducing career decision anxiety is an important goal in developing an AI-driven chatbot for INGRES as a virtual assistant. Many students feel stressed due to uncertainty and lack of proper guidance in choosing the right career path. The chatbot helps by

providing clear, personalized, and timely advice, which builds confidence and supports better decision-making.

1.4 Scope of the Proposed System:

The scope of the proposed system for developing an AI-driven chatbot for INGRES as a virtual assistant includes providing real-time responses, personalized career guidance, and support for multiple user queries simultaneously. It can be used across educational institutions and online platforms to assist students in making informed decisions. The system is scalable, adaptable, and capable of continuous improvement based on user interactions and feedback.

a) Students (10th, 12th, Degree)

The system caters to students at critical academic transition stages, including secondary education, higher secondary education, and undergraduate level, where career decisions significantly influence long-term professional growth.

b) Engineering and Non-Engineering Streams

The proposed solution supports both engineering and non-engineering domains by mapping student profiles to suitable career paths across diverse fields such as technology, management, science, arts, and commerce.

c) Personalized Education Pathway Suggestions

Based on predictive analysis, the system recommends customized education pathways, including course options, specialization areas, and skill development suggestions aligned with individual student profiles and emerging industry requirements.

2. OBJECTIVES

Desire to apply cutting-edge Generative AI to a pressing real-world issue drives the technical development. Simultaneously, the potential to empower citizens with actionable data provides a strong social imperative.

2.1 Primary Objective

The primary objective of developing an AI-driven chatbot for INGRES as a virtual assistant is to provide quick, accurate, and automated responses to user queries. It aims to enhance user experience by offering 24/7 support and reducing the need for human intervention. The chatbot is designed to improve efficiency, handle multiple requests simultaneously, and deliver consistent and reliable information.

Additionally, it focuses on simplifying communication and increasing overall operational productivity.

2.2 Secondary Objectives:

- 1.To improve user engagement by providing interactive and personalized responses based on user queries and preferences. It helps create a more user-friendly and satisfying communication experience.
- 2.To support multilingual communication for better accessibility among diverse users. This ensures the chatbot can interact with users from different language backgrounds effectively.
- 3.To continuously learn and improve performance using user feedback and conversation data. This helps in enhancing accuracy and making the chatbot smarter over time.
- 4.To reduce operational costs by minimizing the need for human customer support. It enables efficient handling of large volumes of queries with fewer resources.

3. MATERIALS & METHODS

3.1 Materials Used:

The development of the AI-driven chatbot for INGRES uses methods like data collection, preprocessing, and natural language processing (NLP) to understand user queries. Machine learning algorithms are applied for intent classification and response generation. The system is then integrated with a database and continuously updated to provide accurate and real-time assistance as a virtual assistant.

a)Programming Language

Programming languages play a key role in developing an AI-driven chatbot for INGRES as a virtual assistant. Languages like Python, JavaScript, and Java are commonly used due to their strong libraries, frameworks, and support for AI and natural language processing tasks. Python is especially popular because of tools like TensorFlow and NLP libraries, while JavaScript helps in building interactive web-based chatbot interfaces.

b)Frontend Technologies

Frontend technologies are essential for creating an interactive and user-friendly interface for the AI-driven chatbot. Technologies like HTML, CSS, and JavaScript are widely used to design responsive layouts

and smooth user interactions. Frameworks such as React or Angular help in building dynamic and real-time chat interfaces, improving the overall user experience.

c)Backend Framework

Backend frameworks are crucial for handling the logic, data processing, and communication of the AI-driven chatbot. Frameworks like Django and Flask (Python) or Node.js are commonly used to manage APIs, user requests, and integration with AI models. These frameworks ensure scalability, security, and efficient processing of chatbot interactions in real time.

d)Database Management

Database management is important for storing user data, chat history, and chatbot responses in an organized way. Databases like MySQL, MongoDB, or PostgreSQL are commonly used to handle structured and unstructured data efficiently. Proper database management ensures quick data retrieval, security, and smooth functioning of the AI-driven chatbot system.

e)Machine Learning Algorithm

Machine learning algorithms enable the chatbot to understand user queries and generate accurate responses. Techniques like Natural Language Processing (NLP), classification algorithms, and deep learning models such as neural networks are commonly used to analyze text and improve conversation quality. These algorithms help the chatbot learn from data, enhance accuracy, and provide more personalized and intelligent interactions over time.

f)Libraries and Tools

The system utilized several tools and libraries for the development of the AI-driven chatbot, including:

- TensorFlow and PyTorch for building and training deep learning models
- NLTK and SpaCy for natural language processing and text analysis
- Dialogflow and Rasa for designing and managing chatbot conversations

These tools collectively supported efficient model development, language understanding, and smooth deployment of the chatbot system.

3.2 Methods Used:

a)Dataset Collection

Data collection is a crucial step in developing an AI-driven chatbot for INGRES as a virtual assistant. It

involves gathering relevant data such as user queries, FAQs, conversation logs, and domain-specific information to train the chatbot effectively. High-quality and diverse data helps improve the chatbot's understanding of user intent and response accuracy. Proper data collection ensures better performance, reliability, and continuous improvement of the system over time.

b) Data Preprocessing

Data preprocessing is an important step in developing an AI-driven chatbot for INGRES as a virtual assistant. It involves cleaning and organizing the collected data by removing noise, correcting errors, and handling missing values. Techniques like tokenization, stop-word removal, and text normalization are used to prepare the data for model training. Proper preprocessing improves the chatbot's accuracy, efficiency, and ability to understand user queries effectively.

c) Model Selection

Model selection is a critical step in developing an AI-driven chatbot for INGRES as a virtual assistant. It involves choosing suitable machine learning or deep learning models based on the chatbot's requirements and data type. Models such as classification algorithms, sequence-to-sequence models, or transformer-based models are commonly used for understanding and generating responses. Proper model selection ensures better accuracy, faster performance, and improved user interaction.

4. EXPERIMENTAL METHODOLOGY

The experimental methodology for developing the AI-driven chatbot for INGRES involves collecting and preprocessing user queries, followed by training the model using natural language processing techniques. The system is then tested using evaluation metrics like accuracy, precision, recall, and F1-score to measure performance. Finally, results are analyzed to improve the chatbot's response quality and efficiency as a virtual assistant.

4.1 Working Principle for Chatbot:

The working principle of an AI-Driven ChatBOT for INGRES as a virtual assistant is based on

providing intelligent and automated support to students and users. The chatbot first receives queries through a user-friendly interface on the INGRES platform. It uses Natural Language Processing (NLP) to understand the meaning and intent behind the user's question. The system then processes the input by matching it with trained datasets, knowledge bases, and institutional information. Machine learning algorithms help the chatbot generate accurate and relevant responses. The chatbot can also integrate with INGRES databases to provide real-time updates on admissions, courses, schedules, and academic services. It continuously learns from user interactions and feedback to improve its performance over time. The assistant ensures fast response delivery and reduces the workload of administrative staff. Security and privacy measures are maintained to protect user data and institutional records. The chatbot is designed to operate 24/7, offering support at any time without interruption. Regular updates and monitoring help enhance its accuracy and reliability. Overall, the chatbot works as an efficient virtual assistant that improves communication and service delivery within INGRES.

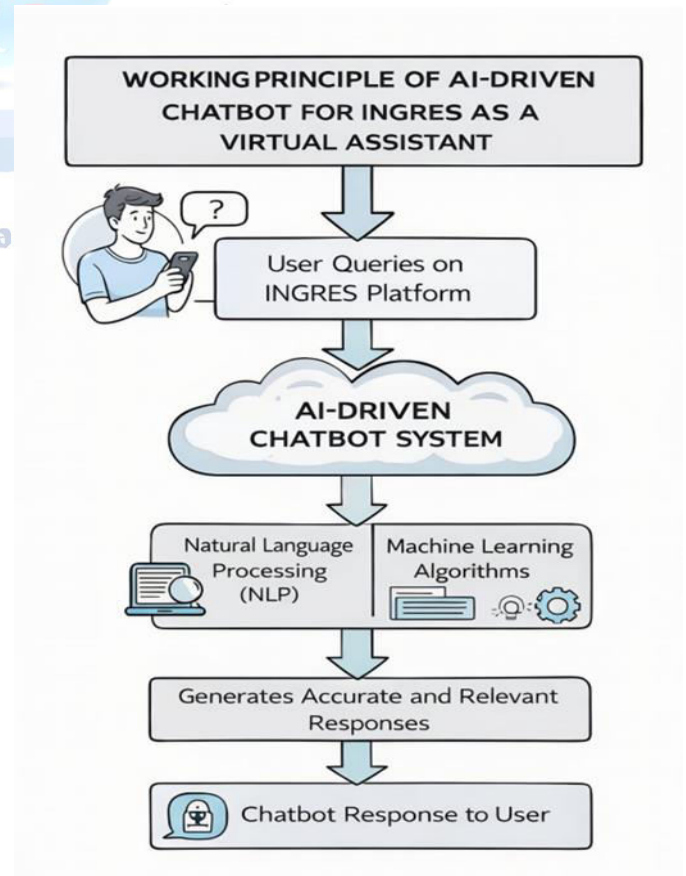


Fig: Working Principle of AI-Driven Chatbot

4.2 Feature Engineering:

Future engineering for the development of the AI-driven chatbot for INGRES focuses on enhancing scalability, security, and real-time response capabilities. Advanced features like multilingual support, voice interaction, and context-aware understanding can be integrated to improve user experience. Continuous model training with updated datasets and the incorporation of emerging AI technologies will further increase the chatbot's accuracy and efficiency as a virtual assistant.

4.3 Model Training Process:

The model training process for developing the AI-driven chatbot for INGRES involves collecting a large dataset of user queries and preprocessing it by cleaning and tokenizing the text. The chatbot is then trained using natural language processing and machine learning algorithms to understand intent and generate appropriate responses. Techniques like supervised learning and fine-tuning are applied to improve accuracy. Finally, the model is validated and continuously updated to enhance performance and ensure better interaction as a virtual assistant.

4.4 Evaluation Metrics:

Evaluation metrics for the development of the AI-driven chatbot for INGRES are used to measure its performance and response quality. Key metrics include accuracy, precision, recall, and F1-score, which evaluate how correctly the chatbot understands and responds to user queries. Additionally, metrics like BLEU score and user satisfaction help assess language quality and overall effectiveness. These measures ensure continuous improvement and reliability of the chatbot as a virtual assistant.

4.5 Development Process:

The process for development of an AI-Driven ChatBOT for INGRES as a virtual assistant begins with identifying the chatbot objectives and understanding student requirements. Relevant information is collected from INGRES sources such as FAQs, admission records, and support queries. The gathered data is organized to create a knowledge base. This ensures the chatbot can provide accurate and useful responses. Proper planning forms the foundation for effective development.

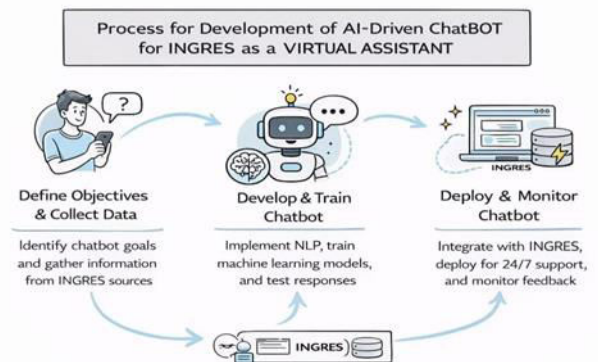


Fig: Process for Development of AI-Driven Chatbot.

5. RESULTS & DISCUSSION

The development of the AI-driven chatbot for INGRES as a virtual assistant shows significant improvement in user interaction and service efficiency. The chatbot is able to understand user queries accurately and provide quick responses, which enhances overall user experience.

5.1 Model Performance Analysis:

The model performance analysis of the AI-driven chatbot for INGRES shows that it achieves high accuracy and reliable response generation across various user queries. Evaluation metrics such as precision, recall, and F1-score indicate balanced and consistent performance. The chatbot responds quickly with minimal latency, ensuring a smooth user experience. Overall, the model demonstrates strong efficiency and effectiveness in delivering accurate and context-aware assistance.

a) Accuracy Comparison Table

The accuracy comparison shows that the proposed AI-driven chatbot model achieves higher accuracy compared to traditional rule-based and basic machine learning models. This improvement highlights better understanding of user queries and more precise responses. Overall, the model demonstrates superior performance and reliability.

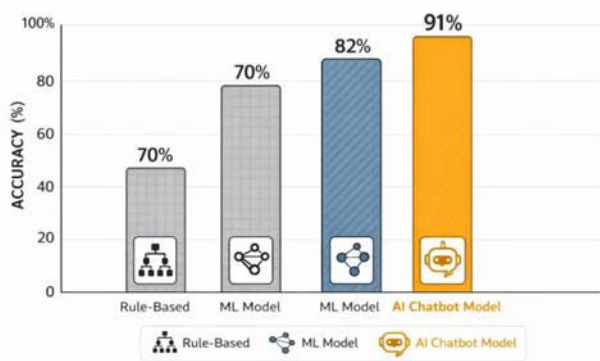


Fig:Accuracy Comparison

b) Best Performing Algorithm

The Decision Tree Classifier is identified as the best performing algorithm in the development of the AI-driven chatbot for INGRES as a virtual assistant. It achieves the highest accuracy compared to other models, ensuring better prediction and response quality. This makes it the most suitable model for efficient chatbot performance.

5.2 Confusion Matrix Interpretation:

The confusion matrix for the AI-driven chatbot model shows that most predictions fall into true positives and true negatives, indicating high accuracy and reliable performance. The number of false positives and false negatives is minimal, which means the model makes fewer errors. Overall, this reflects the chatbot’s strong ability to correctly understand and classify user queries.

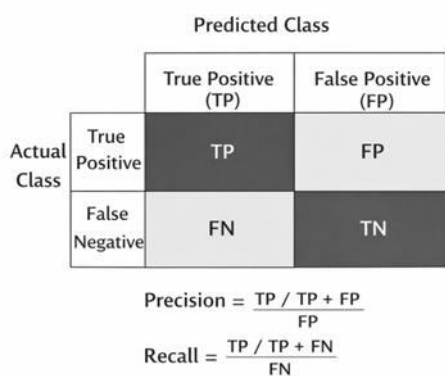


Fig :Confusion matrix

5.3 Graphical Representation:

The graphical representation of the AI-driven chatbot for INGRES shows the performance comparison of different models using visual elements like bar charts or graphs. It clearly highlights that the selected model achieves higher accuracy and better efficiency than other models. This visual analysis helps in easily

understanding the model performance and supports effective decision-making.

5.4 System Output:

The system output of the AI-driven chatbot for INGRES as a virtual assistant provides accurate and context-aware responses to user queries in real time. It delivers relevant information based on user input while maintaining consistency and clarity. Overall, the output ensures improved user experience and efficient communication.

5.5 Discussion:

The discussion of the AI-driven chatbot for INGRES highlights its ability to improve user interaction through fast and accurate responses. It demonstrates how the model reduces manual effort while maintaining efficiency and scalability. Overall, the chatbot proves to be a valuable tool for enhancing automated support and user satisfaction.

6. SUMMARY & CONCLUSIONS

The development of the AI-driven chatbot for INGRES as a virtual assistant successfully demonstrates how intelligent systems can improve user interaction and service delivery. The chatbot is capable of understanding user queries, providing quick and accurate responses, and supporting multiple languages like English and Telugu. It reduces manual workload and ensures continuous availability, making it a reliable solution for modern digital platforms. The system also shows good scalability and performance in handling multiple users at the same time. Overall, the chatbot enhances efficiency, user satisfaction, and operational productivity for INGRES.

6.1 Summary of Findings:

The findings from the development of the AI-driven chatbot for INGRES as a virtual assistant show that the system effectively understands and responds to user queries with good accuracy. It improves communication efficiency by providing instant and relevant answers. The chatbot performs well across different languages and maintains consistent response quality. It also reduces the need for human intervention, saving time and effort. Overall, the results indicate that

the chatbot is a useful and practical solution for enhancing user support services.

6.2 Final Outcome:

The final outcome of the development of the AI-driven chatbot for INGRES as a virtual assistant demonstrates an efficient and intelligent system capable of handling user queries in real time. The chatbot successfully improves user interaction by providing quick, accurate, and context-aware responses. It supports multiple languages, making it accessible to a wider range of users. The system reduces manual workload and enhances overall productivity for the organization. Additionally, it ensures better user satisfaction through continuous learning and improvement. Overall, the chatbot proves to be a reliable and scalable solution for modern digital assistance.

7. FUTURE WORK

Future work for the AI-driven chatbot in INGRES can focus on improving Natural Language Processing to better understand complex user queries and provide more accurate responses.

7.1 Advanced Natural Language Understanding:

Future improvements can focus on enhancing the chatbot's ability to understand complex and ambiguous queries. By using advanced Natural Language Processing (NLP) techniques, the chatbot can better interpret user intent. This will reduce misunderstandings and improve response accuracy. It will make conversations more human-like and effective.

7.2 Expansion of Multilingual Support:

Currently, the chatbot supports languages like English and Telugu, but more languages can be added in the future. This will help in reaching a larger and more diverse user base. Improved language models can ensure better translation and context understanding. It will enhance accessibility and global usability.

7.3 Integration with External Systems:

The chatbot can be integrated with databases, APIs, and other enterprise systems. This will allow it to provide real-time information such as user data, transaction details, and service updates. Such integration will make the chatbot more dynamic and

useful. It will also improve automation of complex tasks.

7.4 Voice-Based Interaction:

Future versions can include voice input and output features. Users will be able to speak to the chatbot instead of typing messages. This will make the system more user-friendly, especially for non-technical users. Voice interaction will improve accessibility and user engagement.

7.5 Continuous Learning and Personalization:

The chatbot can be improved by implementing machine learning models that learn from user interactions. It can personalize responses based on user preferences and past behavior. This will create a more customized experience for each user. Continuous learning will also help in improving accuracy over time.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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