Smart Virtual Assistant Academic Model for a University Website

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Abstract:- This paper presents the query chatbot system implemented by an institution, which is designed to deliver prompt and efficient responses to inquiries from both students and faculty members. Machine learning algorithms and natural language processing techniques were used in the creation of the chatbot. Using a dataset of commonly asked questions by students, we evaluated the system's functionality. The outcomes showed that the chatbot could deliver precise answers on schedule. The system's ability to provide prompt responses to often-asked questions might potentially save time for both teachers and pupils. Our study demonstrates the value of chatbots in educational environments and suggests avenues for further investigation into this area. A conversational buddy is a piece of software that facilitates online text or voice messaging conversations. They can contextualize human participation, making dialogue more interesting. A powerful tool for building chatbots that can serve as a college inquiry system is the Python framework Rasa X The goal of this research project is to establish guidelines for building a dynamic chatbot that can communicate with users via text and speech.

Keywords:- Natural Language Processing Techniques, Institution's Query Chatbot System, Machine Learning Algorithms, Text and Voice Messages, Contextualizing Human Participation, Python Framework, Human-Computer Interaction, Frequently Asked Queries, Construction of a Dynamic Chatbot.

I. INTRODUCTION

Information about a college, including a schedule, upcoming events, faculty profiles, exam schedules, new assignments and projects with due dates, and much more, is often needed by college students. It is inconvenient and time-consuming to make phone calls, visit the school website, or send emails because you have to wait a long time to hear back. In rare cases, if there is no physical support available, calling does not help[1]. Chatbots have altered human interaction more than in the past few years. It has been observed that the majority of websites favor chatbot interaction over real customer service calls. Because of this, the most accessible and user-friendly method is a voice chatbot, which is readily available. An internet connection, a mobile device, or other computing equipment can be used by anybody, anywhere, at any time, to solve problems. The purpose of this research is to determine the appropriate software components needed to develop a chatbot support system using machine learning and natural language processing[1]. The system should be able to accept text and voice input, understand the intent and body of user messages, and be easily integrated with a college website to provide students and parents with precise and accurate answers to questions about college[2]. Without using any real human beings, to lessen the workload on university administrations and enhance communication between students and colleges while promoting student participation through an excellent user experience and prompt response.

II. LITERATURE SURVEY

Kakumani Manasa[6], in the paper titled "College Enquiry Chatbot," has proposed that a chatbot system can be a valuable tool for streamlining information dissemination within educational institutions. The paper delves into how this chatbot leverages Natural Language Processing and Artificial Intelligence to efficiently address a wide range of user queries related to various college aspects. Manasa highlights the chatbot's intuitive interface and its round-the-clock availability, catering perfectly to students seeking instant information on courses, fees, facilities, and other college-related matters. However, the paper also acknowledges limitations. While the chatbot excels in rapid response times and user convenience, it can struggle with handling intricate queries. The current system relies on a predefined set of questions, potentially limiting its adaptability and versatility. Additionally, the inability to understand specific problems or perform tasks for users remains a noteworthy constraint. These drawbacks underscore the need for further development to enhance the chatbot's capabilities and ultimately improve user satisfaction. Manasa's paper paves the way for future enhancements, such as integrating speech recognition and augmenting the chatbot's knowledge base with department-specific data.

By addressing these limitations, the College Enquiry Chatbot has the potential to redefine student engagement with educational establishments, ushering in a new era of accessible and efficient communication.

➢ *Beyond these core Functionalities, the Paper Emphasizes Several Key Advantages of the Chatbot System:*

- **Enhanced User Flexibility:** Unlike previous systems that might have presented users with limited options, this chatbot responds directly to student queries, offering greater flexibility and catering to more nuanced questions.

- **24/7 Accessibility:** The service operates around the clock, ensuring that students can access information whenever they need it, regardless of time zone or personal schedules. This continuous availability significantly improves accessibility for students with busy schedules or those seeking information outside of traditional business hours.

- **Faster Processing Speeds:** The paper boasts that this chatbot system offers significantly faster processing speeds compared to its predecessor. This translates to quicker response times, minimizing wait times and frustration for students seeking information.

- **Improved Overall Efficiency:** By offering faster processing and direct response to queries, the chatbot system enhances overall efficiency for both students and the institution. Students receive answers promptly, and the institution benefits from a streamlined information dissemination process.
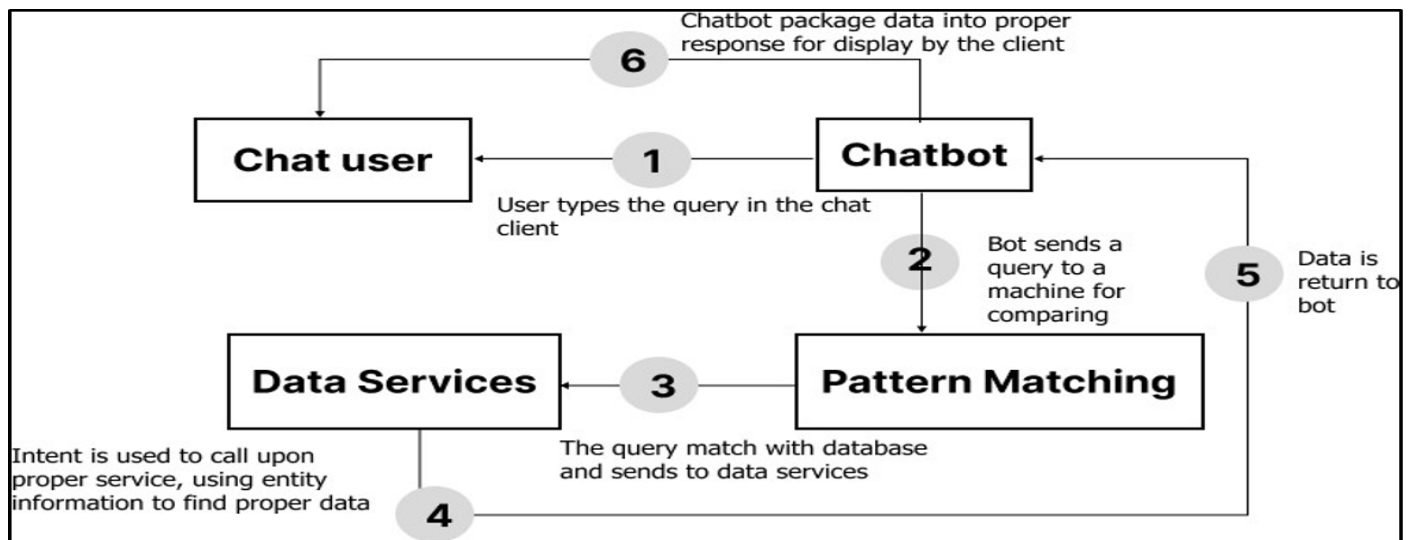

Fig 1 Architecture of the Chatbot

Gokul R[7] has presented a college inquiry chatbot system designed to provide quick and efficient responses to student queries. The chatbot was built using natural language processing techniques and machine learning algorithms. We evaluated the performance of the system by testing it with a dataset of commonly asked student queries. The results showed that the chatbot was able to provide accurate responses promptly. The system has the potential to save time for both students and staff by providing instant answers to commonly asked questions. Our study highlights the effectiveness of chatbot systems in educational environments and suggests the potential for future research in this area. I conversational assistant is a computer program that can be used for online interaction through text or voice messages. They can make human interaction contextual which leads to actual engaging interaction. Python's Rasa X is a framework that is a powerful tool in the creation of chatbots that can serve as a college inquiry system. This research study is focused on identifying the requirements for the development of a dynamic chatbot that supports text as well as voice-based interaction with the users.
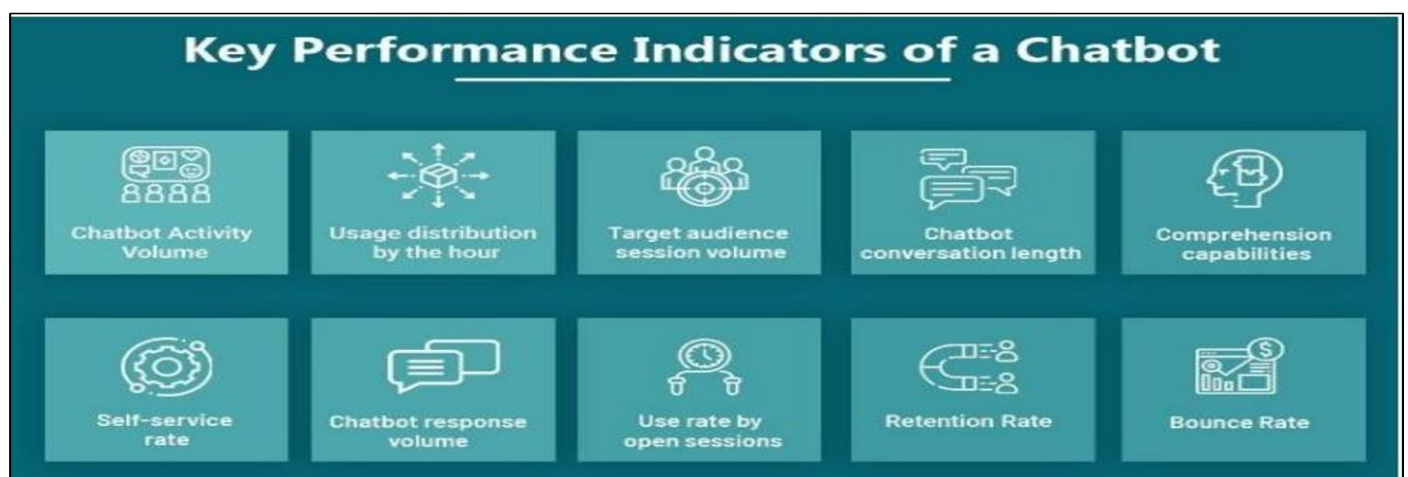

Fig 2 Key Performance Indicators of a Chatbot

> *Drawbacks:*

The chatbot proposed in the study is limited to processing and responding to questions only in English, as it relies on RasaNLU, which supports English exclusively. Although spaCy, a default pipeline for processing user inputs in Rasa, functions effectively under low server capacity, accommodating increased demand may pose challenges, necessitating a higher configuration server for hosting the chatbot application.

Kumar's research (2023) examines how Educational Chatbots (ECs) can improve project- based learning. The study explored how well ECs worked in a design course with teams. The researchers used a mix of methods to assess the impact of ECs. This included testing students' knowledge before and after the project, and observing how they worked together. The results showed that teams using ECs collaborated and learned better. However, the ECs didn't seem to affect students' motivation or confidence in their creativity. This research suggests a new way to design learning with ECs. By exploring how ECs work in project-based learning, the study offers valuable insights for creating and improving ECs for education. Overall, Kumar's research highlights the potential of ECs to make project- based learning more collaborative and effective. While ECs show promise, more research is needed to see how they affect students' motivation and confidence. With further development, ECs could become a powerful tool for personalized and engaging learning experiences.

Table 1 Educational Task of ECs

Task	Description
Administrative and management	EC is utilized to facilitate the learning activities' onboarding.
FAQ Platform	On administration-related or educational-related FAQs, EC offers input.
Mentoring	EC is used to track the affective and cognitive learning outcomes of pupils.
Motivational	EC provides emotional and motivational support
Practice specific skills and abilities	EC is used as a practice buddy to learn a language, communication, and programming
Simulations	EC is used to simulate conditions that aid with rehabilitation, such as in healthcare
Refection and metacognitive strategies	EC is used as a skillful classmate that aids learning
Student learning assessment	ECs measure learning outcomes quickly and routinely

Table 2 Describing RiPE for educational chatbots

Factors	Description
Reliability	The chatbot should be easy to access through a stable and private platform where the learner can depend on the chatbot to gain continuous feedback with confidence.
Interpersonal communication	The chatbot promotes learner-learner and learner- instructor connections through activities that Encourage sharing, communication, and collaboration.
Pedagogy	The chatbot, tailored to course objectives, offers learning content and activities while fostering a personalized experience. It incorporates active learning and communication strategies, enabling instructors to track student progress.
Experience	Our chatbot, designed for a popular messaging app, mimics the natural conversational style of students online. We enhance emotional engagement through friendly greetings, humour, emoticons, and empathy. The interaction is centered around concise educational modules tailored for micro-learning, ensuring effective knowledge transfer in bite-sized chunks.

III. METHODOLOGY

The study utilizes a mixed-methods quasi-experimental design, involving the integration of ECs in a design course focused on team-based projects. Quantitative data are gathered through pre-and post-assessments to measure learning performance and teamwork effectiveness. Additionally, qualitative data are collected through interviews and observations to understand the impact of ECs on collaboration and affective-motivational learning outcomes.

Chandan A J has proposed in his paper "Implementing chatbot in educational institutes" the utilization of chatbot technology to address the challenges associated with disseminating information in educational institutions. This paper explores how chatbots can provide immediate and personalized assistance to students regarding admissions, courses, and general inquiries, thereby reducing frustration and inefficiencies for both students and administrative staff. By integrating chatbots into the institute's website infrastructure, students can conveniently access tailored information, alleviating administrative burdens and significantly enhancing the overall student experience. Chatbots offer a seamless and interactive platform for students to inquire about admission requirements, course details, deadlines, and other pertinent information in real time. This technology not only facilitates quick responses to common queries but also optimizes operational efficiency within educational institutions by freeing up administrative resources to focus on more complex tasks. The adoption of chatbots in educational settings represents a promising opportunity to streamline communication processes, improve information accessibility, and enhance student satisfaction.

> *Challenges Faced by Students:*

Students encounter various difficulties when seeking information about institutions, admission processes, and

other inquiries. Common challenges include navigating complex websites, long response times from administrative staff, and limited availability of information outside office hours. These challenges can lead to delays in decision-making and increased stress for students.
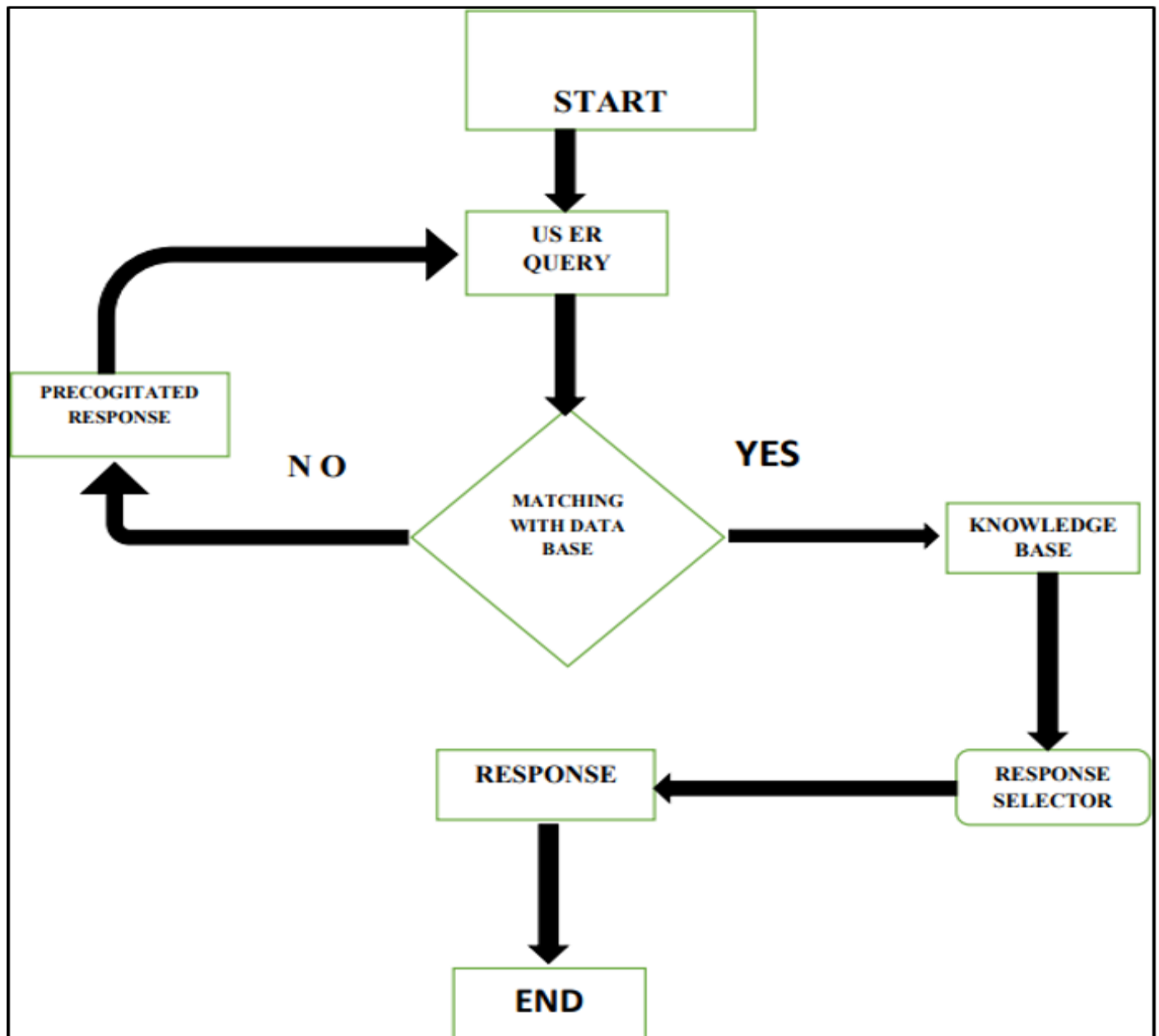

Fig 3 Flow Chart of the Proposed Model

Dr. M. Senthil Kumar[10], in the paper titled "An Automated Chatbot for an Educational Institution Using Natural Language Processing," presents a comprehensive study on developing and deploying a specialized chatbot tailored for educational contexts. The paper discusses the increasing adoption of chatbots across industries and emphasizes their role in facilitating human-like interactions and support. Beginning with an introduction to chatbots and their importance in user assistance, the paper highlights the significance of Natural Language Processing in enabling chatbots to understand and respond effectively to user queries. The study outlines project objectives, focusing on the need for a chatbot solution capable of efficiently providing college details, student records, and responding to CGPA inquiries to streamline information retrieval processes and enhance user experience. The methodology section details core modules used in chatbot development, including pre-processing, feature extraction, context identification, and a personalized query response system, alongside discussing the NLP algorithm implemented. The results section showcases the chatbot's proficiency in various tasks, supported by screenshots illustrating functionality. Concluding remarks explore future enhancements such as image and currency recognition, emphasizing the paper's contribution to developing educational chatbots leveraging NLP techniques to enhance user experiences and operational efficiency within institutions.
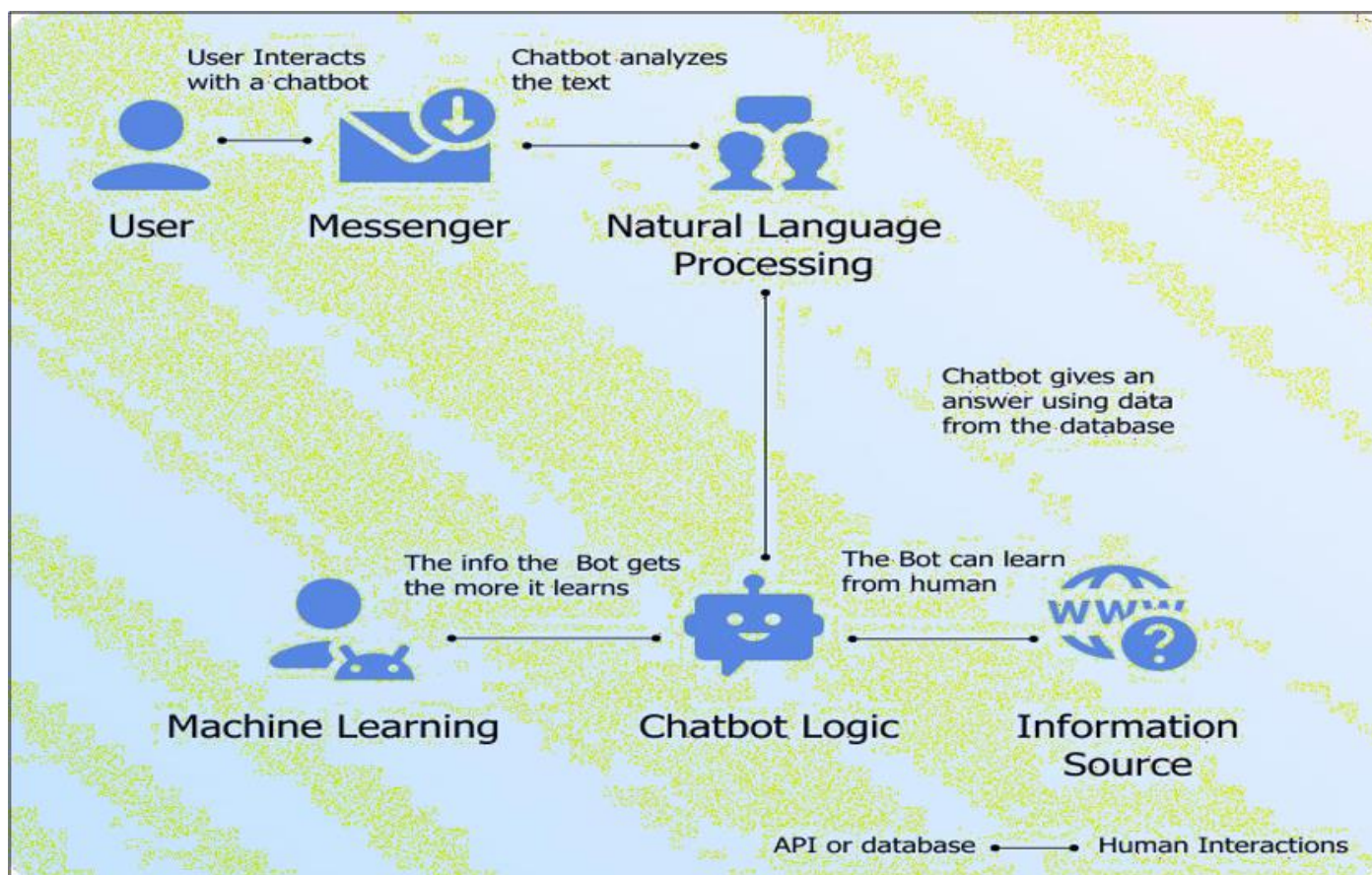
Fig 4 Architecture of the Proposed System

Chokri Kooli[12], in the paper titled "Chatbots in Education and Research: A Critical Examination of Ethical Implications and Solutions," undertakes a thorough exploration of the ethical considerations surrounding the use of chatbots and AI systems in academic settings for teaching and research purposes. Through expert analysis, qualitative methodologies, and a comprehensive review of existing practices, constraints, and potential remedies, this study delves into the opportunities and challenges posed by this technology. The paper addresses ethical concerns such as misuse and exploitation while also highlighting the advantages and disadvantages of AI systems and chatbots, emphasizing their role in complementing human expertise. Furthermore, the article underscores the importance of sustainability and ethical awareness in the context of AI-driven education, advocating for necessary adjustments in evaluation methodologies. By advocating for awareness, policy changes, and principled approaches, the paper reframes AI systems and chatbots as educational innovators rather than mere threats, aiming to navigate the evolving landscape of AI-driven education responsibly and ethically.

Vajinepalli Sai Harsha Vardhan's[13] research paper on "Chatbot Model Classification and Literature Review" thoroughly explores various types of chatbot models categorized by techniques like template-based keyword identification and pattern matching, exemplified by ELIZA and PARRY. The literature review section surveys studies such as "Chatbot for Student Admission Enquiry" and "Chatbot for College Enquiry," demonstrating the versatile applications of chatbots across domains. The paper details a proposed chatbot system architecture utilizing Python's chatterbot algorithm to automate responses within an online application, emphasizing chatbots' broad utility in educational, business, and customer service contexts. The evaluation highlights the system's efficiency in time and resource-saving, proposing future enhancements like language expansion and speech-based interactions to enhance user experience and problem-solving capabilities. In conclusion, the paper underscores the successful development of a rule-based chatbot algorithm for user queries and its potential to enhance efficiency across industries through streamlined interactions.

Results, Future Scope, and Conclusion: The results and discussion section critically.

Table 3 Techniques and Models used in some Chatbots

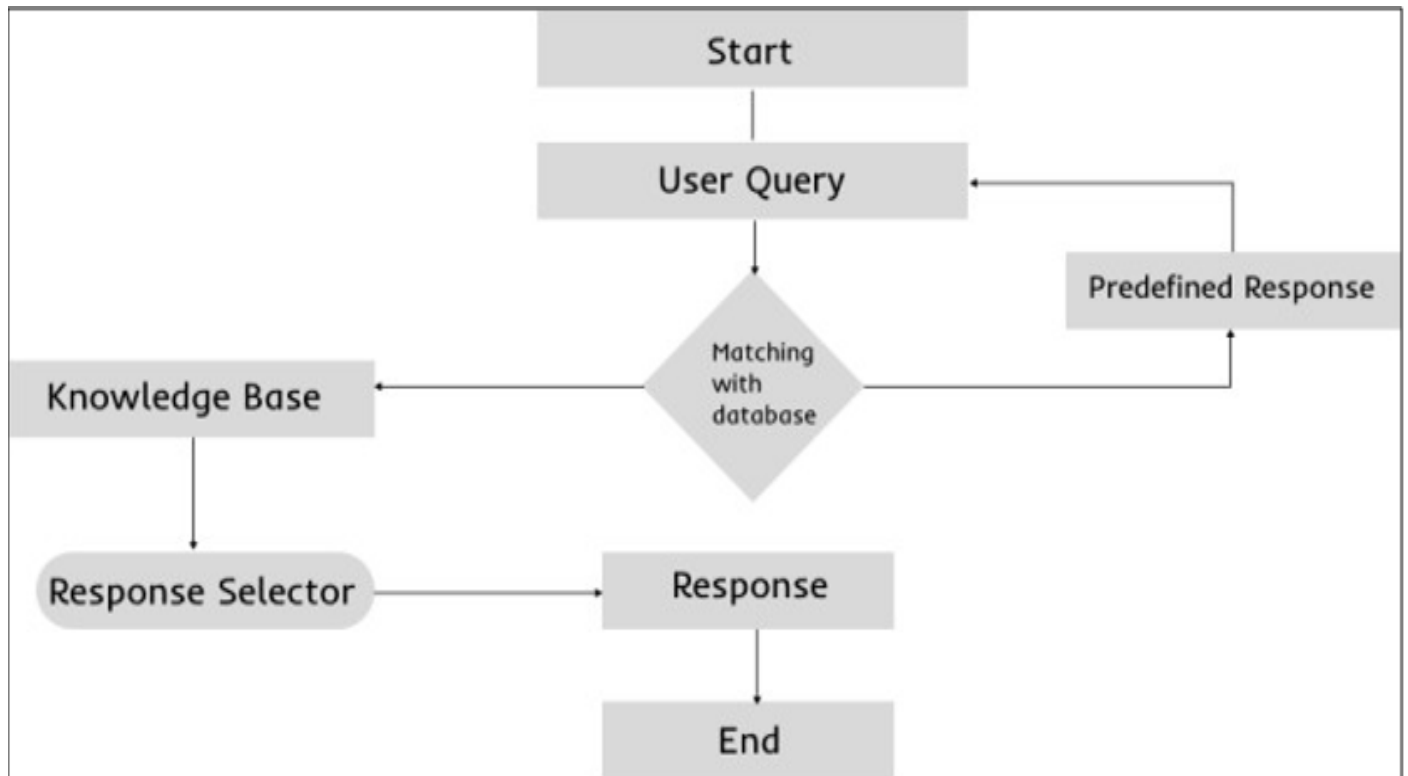| Chatbot Name	Model	Technique used
ELIZA	Template Based	Identification of keyword and Pattern matching
PARRY	Conversational model and Template	Pattern matching with transformation rules

Fig 5 Flowchart of Query Solvers

Giovanni Almeida[24] Santos explores a conversation-driven approach to chatbot management in his study, addressing the challenges of maintaining and enhancing chatbot content while ensuring a consistent user experience. The Chatbot Content Administration Process (CCMP) proposed in this research aims to streamline chatbot content administration, inspired by the development process of the Evatalk chatbot used by the Brazilian Virtual School of Government. This paradigm prioritizes content enhancement through a human- guided, cyclical process focusing on management, building, and analysis stages, clarifying the roles within a chatbot team. Evaluation using Evatalk within the Brazilian Virtual School of Government, which engaged with 22,771 students in 2020 out of 1,698,957 enrolled, demonstrated positive outcomes with the CCMP implementation, maintaining high response confidence and user satisfaction while reducing human intervention from 44.43% to 30.16% and expanding the knowledge base by 160%. The study also contextualizes the evolution of chatbots from ELIZA in the 1960s to their increasing popularity since the 1990s, emphasizing design considerations like usability and scalability to enhance user experience and manage growing interactions and information effectively. Santos highlights how chatbots not only reduce costs and improve support operations but also provide valuable insights into customer preferences and interests through interaction data.
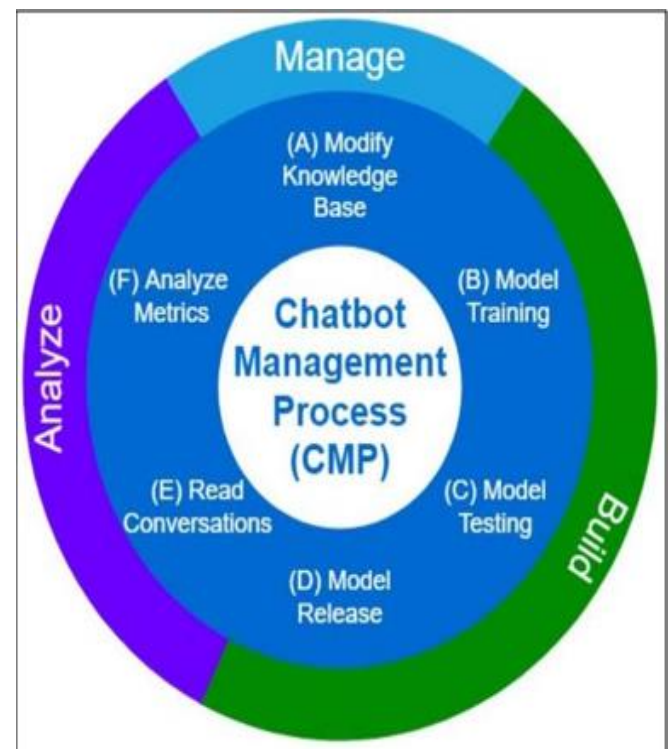

Fig 6 Chatbot Management Process Proposed by this Work

Using conversation data to produce new information and enhance content management is one method of using chatbots to deliver great customer support. The task at hand poses a multifaceted problem that encompasses technical deployment, content management, and data analysis. To turn the massive amounts of data produced by chatbots into insightful knowledge, a team with specialized expertise is needed to manage them. Customer satisfaction and the chatbot's capacity to handle problems without the need for human intervention are ultimately directly impacted by efficient chatbot content management. This work presents a mechanism for managing content in text-based chatbots under human supervision. By building and managing the Evatalk chatbot, which handled 22,771 encounters between May and December 2020, the efficacy of the approach was assessed. The following is the format of the paper: The study is organized as follows: Section II provides context for chatbot design and methodology; Section III presents the proposed Chatbot Content Management Process (CMP); Section IV examines the outcomes of applying CMP to the Evatalk project; and Section VI wraps up.

Noorhan Abbas[11] explores the utilization of online chat and chatbots to enhance mature student engagement in higher education, addressing prevalent challenges such as feelings of isolation and disconnection that often impact older students returning to school. The study introduces "Differ," an innovative online chat platform featuring a chatbot named "Bo," which was implemented as part of a pilot trial at a UK institution to proactively address issues related to reduced participation in Facebook groups dedicated to specific academic programs. To support this initiative, sixteen student mentors were strategically selected and trained to actively monitor online communities and encourage meaningful participation among students. Through a robust mixed-methods approach encompassing interviews, focus groups, and questionnaires, researchers systematically collected valuable feedback from both mentors and students involved in the pilot program. This comprehensive data collection methodology facilitated insights into the organic formation and dynamics of student-led online communities, shedding light on effective strategies to enhance student engagement and combat feelings of isolation among mature learners. The research underscores the profound importance of fostering social connections with peers and instructors in mitigating the sense of loneliness experienced by mature students returning to academic pursuits. It emphasizes how online participation, facilitated by platforms like "Differ" and supported by interactive chatbots such as "Bo," can play a pivotal role in cultivating a sense of belonging and providing vital support to remote learners grappling with time constraints.

By delving into the impact of "Differ" and "Bo" on senior students' engagement and sense of belonging at the University of Leeds' Lifelong Learning Centre, the study contributes significantly to the evolving discourse on leveraging online communities to empower mature students in higher education. The findings not only advance our understanding of the potential of online platforms to assist mature learners but also offer actionable recommendations to optimize student interactions within virtual communities and

enhance overall student engagement and support in digital learning environments. This research underscores the transformative impact of technology-enhanced educational strategies in fostering inclusive and supportive learning experiences for diverse student populations, ultimately striving to promote lifelong learning and academic success among mature learners navigating higher education landscapes.

Sanjay Chakraborty explores the potential of AI-based medical chatbots for infectious disease prediction, aiming to leverage chatbot technology to enhance public health awareness and disease prevention. The research identifies a gap in existing literature regarding guidelines for deploying medical chatbots effectively and proposes a deep learning-based chatbot interaction and prediction model. Testing of the model demonstrates promising results with a minimal loss of 0.1232 and an accuracy of 94.32%. However, the study acknowledges the challenges associated with implementing medical chatbots, particularly during pandemics like COVID-19.The investigation delves into the various applications and features of chatbots in the healthcare industry while acknowledging the complexities of utilizing such technology in critical healthcare scenarios. By advancing knowledge of AI technologies and their potential to improve healthcare services, the research aims to contribute to disease prevention and management.The research proposal suggests using AI-powered chatbots to address critical issues such as ensuring access to oxygen for severe COVID-19 patients, especially in resource-limited settings. Chatbots, increasingly adopted across industries including healthcare, serve as conversational agents that engage users through text or speech, providing accessible information and promoting dialogue.The AI-powered chatbot system described in the study utilizes natural language processing and machine learning to understand user inquiries and deliver relevant responses based on data from multiple sources. This approach enables the chatbot to provide accurate and timely information to users, operating continuously with only an internet connection and power supply.The history of chatbots in healthcare dates back to early examples like ELIZA, a text-based psychotherapy simulator developed in 1966. More recently, organizations such as the World Health Organization have utilized chatbots on platforms like Facebook Messenger to combat misinformation and disseminate accurate information about COVID-19. This research underscores the evolving role of chatbots in healthcare and their potential to revolutionize disease prediction, prevention, and management through innovative AI technologies.

Ranci Ren's research focuses on assessing usability enhancements applied to the SOCIO chatbot prototype (V1) through a series of experiments in academic settings, specifically examining its effectiveness in UML modeling tasks compared to the Creately tool. The study employed a family of experiments involving 87 students from three different countries to evaluate user satisfaction, overall experience quality, and task completion efficiency. Results indicated that students were more satisfied with SOCIO V1 compared to Creately and found it more helpful in completing

tasks, although there were no significant differences in effectiveness or quality between the two tools.This research demonstrates the use of a comprehensive approach involving multiple experiments to evaluate and enhance chatbot usability, providing valuable insights into usability studies within the realm of chatbot technology. The study builds upon earlier assessments of SOCIO (V0) and highlights the iterative improvement process by developing SOCIO V1 based on previous research findings to enhance its usability for collaborative modeling activities in social networks like Twitter and Telegram.The central research question of the study, "How can chatbot usability be improved based on evidence from a family of experiments in academic settings?" was addressed by engaging senior computer engineering and mathematics students in UML modeling assignments using SOCIO V1 and comparing it with Creately. Both qualitative and quantitative analysis techniques were employed to evaluate user experience, with statistical analysis applied to experimental data for quantitative insights and theme analysis used to interpret qualitative user feedback. This research contributes to advancing the understanding of chatbot usability evaluation and enhancement methods, particularly in collaborative modeling contexts within academic environments.

Gwendal Daniel's paper introduces Xatkit, a multimodal low-code chatbot development framework aimed at addressing challenges faced in the development and deployment of chatbots and voicebots across various industries like customer care and e-commerce. Existing frameworks often lack flexibility for complex interactions and require significant technical expertise, while deployment can be platform-specific, increasing development costs and maintenance efforts.

Xatkit is presented as a solution to these challenges by providing a set of Domain-Specific Languages (DSLs) to define chatbots and voicebots in a platform-agnostic manner. This approach enables developers to specify chatbot behavior and logic in a way that is compatible with multiple platforms. Additionally, Xatkit includes a runtime engine that automates chatbot deployment and manages conversation logic seamlessly across chosen platforms. The framework's modular design allows for independent updates to specific components, enhancing flexibility and scalability. Being open-source and available online, Xatkit aims to democratize chatbot development, enabling a broader spectrum of developers to leverage its capabilities without extensive technical knowledge.In summary, Xatkit offers a comprehensive solution for building and deploying chatbots and voicebots efficiently, empowering developers to create sophisticated conversational interfaces with ease and flexibility, regardless of the target deployment platform. This framework represents a significant advancement in low-code chatbot development, facilitating the widespread adoption of conversational AI across diverse industries and use cases.
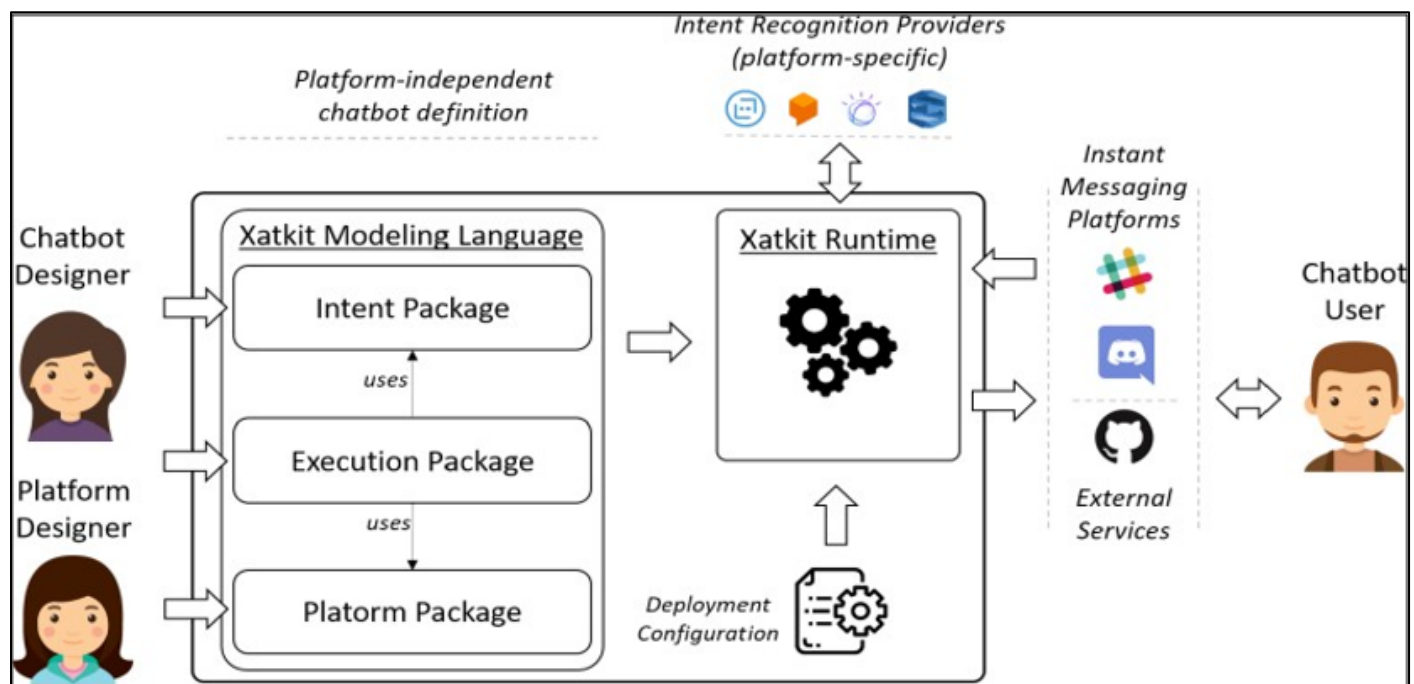

Fig 7 Xatkit Framework Overview

The popularity of instant messaging platforms has led to the widespread adoption of chatbots and automated programs that interact with users. Chatbots are used in various fields, such as customer service, education, and e-commerce. However, developing complex chatbots with advanced features can be challenging due to several factors.

- Technical complexity: Building chatbots requires expertise in natural language processing (NLP) and integrating external services.
- Vendor lock-in: Existing chatbot platforms often limit customization and flexibility by tying developers to specific NLP providers or platforms.

- Limited abstraction: Chatbots often struggle to integrate seamlessly with various external platforms and services.
- This paper introduces Xatkit, a novel framework that addresses these challenges by promoting a more abstract approach to chatbot development. Xatkit utilizes Model-Driven Engineering (MDE) techniques to offer several key features:
- Domain-specific languages (DSLs): Xatkit provides user-friendly languages to define conversation flows, user intentions, and actions.
- Platform independence: Chatbot definitions in Xatkit are independent of specific platforms or NLP engines, allowing for greater flexibility and reusability.
- Runtime interpretation: Xatkit includes a runtime engine that automatically deploys and manages chatbots on different platforms.
- Xatkit offers several improvements over previous work:
- Event-based conversations: Chatbots can now react to external events, not just user-initiated interactions.
- Enhanced tool maturity: More platforms and features are now supported.
- Validation and packaging: Xatkit has been used in an educational setting and provides a development toolkit for easier contribution.

Khang Nhut Lam's project focuses on developing a Vietnamese text-to-text virtual assistant using Transformer models to support students at a large university. The virtual assistant comprises components including an open-domain chatbot trained on movie dialogue, a closed-domain chatbot trained on a dataset of university-related question-answer pairs, and an integrated system to classify and route inquiries to the appropriate chatbot. The study addresses challenges related to handling misspellings and diacritical marks in Vietnamese text inputs, proposing solutions such as a kNN algorithm for integrating chatbots and Transformer models for spelling correction and diacritic restoration.Key contributions of the project include a generative chatbot architecture utilizing Transformers, two datasets for training Vietnamese chatbot models, a method for developing training datasets for closed-domain chatbots, and innovative Transformer-based models for diacritic restoration. The literature review highlights sequence-to-sequence and Transformer-based models as effective techniques for chatbot development, discussing challenges such as diverse writing styles and regional vocabulary comprehension.The proposed solution emphasizes the importance of generative capabilities and diacritic management in enhancing chatbot performance. The publication summarizes its contributions, underscores the utility of Transformer models, and suggests future research directions such as refining chatbot models, expanding datasets, and exploring support for additional languages. This work contributes to advancing chatbot technology, particularly in the context of educational virtual assistants tailored for specific languages and writing systems.

IV. CONCLUSION

With the help of a generation-based model based on the attention-only Transformer neural network architecture[5], we have created a virtual assistant specifically for students. Our method excels at building chatbots for colleges equipped with a database of question- answer pairs. Using Transformer-based models, we have developed a system that is capable of responding to kannada queries with misspellings and no diacritical marks. Although we haven't tested our suggested models on datasets in additional languages, we are optimistic about their ability to improve chatbots in languages that use Kannada script with diacritical marks[7]. In real-world experiments involving real users, our SPEAKEASE can successfully respond to questions that are not in the training dataset, understand inquiries that are misspelled or lack diacritical marks, and provide pertinent answers[10]. We're always investigating ways to improve our virtual assistant system even further strategies to automatically add more features and broaden the training dataset in order to meet the different demands of pupils.

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