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Review on Chatbot using Artificial Intelligence

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Abstract:- Artificial intelligence (AI)-powered chatbots have drawn a lot of interest lately because of their potential to completely change how people interact with computers. They function as virtual conversational agents that are able to comprehend user inquiries and provide natural language responses. The goal of this survey article is to present a thorough review of the developments, methods, and uses of AI-powered chatbots.This survey study intends to provide researchers, developers, and practitioners with a thorough understanding of the state-of-the-art methods and applications in this quickly developing subject by providing an overview of chatbots employing artificial intelligence. It is a useful tool for stimulating new ideas and developments in the creation of chatbots driven by artificial intelligence.

Keywords*: Chatbots, Artificial Intelligence, Natural Language Processing, Dialogue Management, Context Understanding, Multiple Language Support, Grammar and Parsing algorithms.*

1. Introduction

Chatbots, powered by Artificial Intelligence (AI), have emerged as a transformative technology in the domain of human-computer interactions. They serve as virtual conversational agents capable of understanding and responding to user queries in a natural language format. The use of AI in chatbots enables them to provide personalized and efficient interactions, enhancing user experiences across various domains. This survey paper aims to provide a comprehensive overview of the advancements, techniques, and applications of chatbots using AI. It explores the fundamental components of chatbots, such as natural language processing (NLP), machine learning, and dialogue management. By understanding these foundational concepts, we can better grasp the mechanisms that drive chatbot behaviour. This survey article attempts to be an invaluable resource for researchers, developers, and practitioners by offering a thorough overview of chatbots that use artificial intelligence. It gives them the information and understanding they need to progress the design and development of chatbots driven by AI, facilitating more efficient and interesting human-computer interactions across a range of applications.

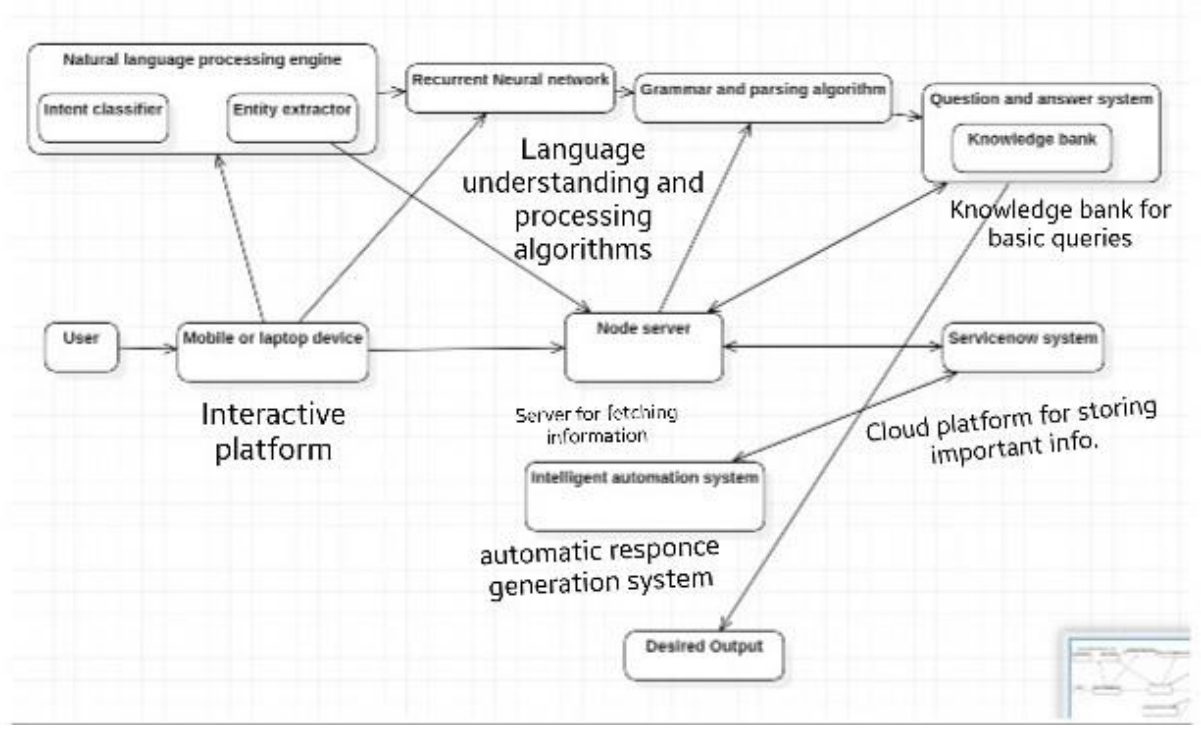

Fig. 1: Architecture of a Chatbot system

1. Literature Survey

Asbjorn Folstad et al. presented new ideas for a deliberative research analysis process: (a) users and consequences; (b) user experience and design; (c) frameworks and platforms; (d) chatbots for collaboration; (e) democratizing chatbots; and (f) ethics and privacy. The six areas of focus are outlined with a five-year outlook in mind and are to be regarded as components of an interdisciplinary research agenda created jointly by enthusiastic field researchers. [1].

Tarun Lalwani et. al. proposed a project aims to develop a smart chatbot using AI and NLP technologies. Implementing an chatbot system for college students using Natural language processing and Artificial Intelligence for college students for admission related queries and viewing user profiles and retrieving attendance and real-time examination updates. The system uses a pre-processing context identification system to understand the appropriate text. [2].

Kshitija Shingte et. al. have created an automated chatbot specifically for students in colleges and universities.The system is designed to help students to know the admission process of the college from anywhere using internet and receive fast replies. This chatbot system reduces the work admissions procedure department by giving parents or students the necessary information and also reduces the workload of the department to keep on answering all the queries of the students.[3].

In his proposed thesis, Jack Cahn talks about the literature review of the design choices, architecture, and algorithms used in chatbots. The basiiic framework of an chatbot system is divided into 3 parts. 1)Dialogic agent, which must understand the user, i.e. provide the function of comprehension. 2)Rational agent, which must have access to an external base of knowledge and common sense such that it can provide the function of competence, answering user questions. [4].

"Rohit Tamrakar" and "Niraj Wani", have survey review on Design and Development of Chatbots for students particularly for the use of Computer-Aided Design (CAD) and various other practical and day-to-day uses. speech and written forms of information are essential. These days, the main modes of communication between people and computers that take place through web apps are speech and textual exchanges.[5].

Chiara Valentina Misischia et al. to improve customer service and its impact on service quality.Firstly, an overview of the main characteristics and functions of chatbots that highlight their applicability for customer service is given, based on a review of current publications in this topic in the literature. Second, two more kinds of chatbot objectives—"improvement of service performance" and "fulfillment of customer's expectations"—are introduced in light of their functional dedication.[6].

Suzana Ilac et al. present a novel chatbot system that is amusingly helpful to users but also caustic, rude, and cranky. From a conversation design standpoint, this chatbot, which is built on deep learning, produces witty and snarky responses. This chatbot's main component, a seq2seq model, is trained on a carefully selected dataset of 3000 question-answer pairings. It has been demonstrated that end-to-end systems can transfer simple linguistic structures representing abstract notions to unknown situations by swiftly learning patterns from limited samples. [7].

Enhancing conversation context in a retrieval-based chatbot was suggested by Amir Vakili and Azadeh Shakery. Retrieval-based chatbot work can be split into two categories: Cross-encoders, which match words across the pair, and Bi-encoders, which encode the pair independently. This division of labor is similar to that of most sequence pair matching tasks. The latter is substantially slower even though it performs better since candidate responses cannot be encoded offline. Multi-layer transformer architectures that have been pre-trained as language models have shown remarkable efficacy in a range of natural language processing and information retrieval applications in recent times.[8].

Table 1. Observations on Literature survey

No.	Title	Algorithms Used	Achieved Accuracy
1]	Future directions for chatbot research: an interdisciplinary research agenda	NA	NA
2]	Implementing an Chatbot using AI and NLP.	Artificial Intelligence and Natural Language Processing	around 90%
3]	Chatbot Development for Educational Institute	Support Vector Machine	94.25%
4]	CHATBOT: Architecture, Design & Development	Automatic speech recognition, Dialogue management.	74%
5]	Chatbot in Customer service: Their relevance and impact on service quality	NA	NA
6]	Designing dialogue systems: A mean, grumpy, sarcastic chatbot in the browser	Greedy search algorithm	97%
7]	Enriching conversation context in retrieval-based chatbots	Natural Language Processing	82%
8]	Feedback-Based Self-Learning in Large-Scale Conversational AI agents	Text-to-speech Recognition algorithm	93.4%

9]	#MeTooMaastricht: Building a chatbot to assist survivors of sexual harassment	Word2vec algorithm	80 %
10]	Design and Development of a chatbot: a Review.	Natural Language Processing	86 %

The observations from a review of 10 research papers are shown in Table (1) below. For each paper, the table lists the title, the algorithm that was employed, and the accuracy that was attained.

2. Proposed Methodology

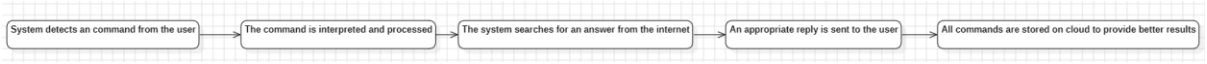

Fig. 2: Proposed Methodology

A detailed methodology for deep learning-based biomedical waste detection and classification is presented, as shown in Fig. 2.

a) Natural Language Processing engine:

Natural Language Processing (NLP) engines are the fundamental backbone of chatbots, empowering them to comprehend, interpret, and interact with human language. These engines process and analyze text inputs, recognize user intents, and extract specific entities from messages. They maintain conversational context, generate contextually relevant responses, and can even gauge user sentiment for more empathetic interactions.

b) Recurrent Neural Network:

Recurrent Neural Networks (RNNs) play a crucial role in chatbots, primarily for handling sequential data, understanding context, and generating text-based responses. In chatbot applications, RNNs are employed to process and generate natural language text, enabling them to follow the flow of conversations. They are instrumental in context maintenance, recognizing user intents and entities, and generating meaningful responses that are contextually relevant.

c) Grammar and Parsing Algorithm:

Grammar and parsing algorithms are essential components in chatbots to ensure accurate understanding of user input and the construction of coherent responses. These algorithms help chatbots break down and analyze user messages to identify the grammatical structure and extract meaningful information. By parsing sentences, chatbots can pinpoint nouns, verbs, adjectives, and other elements, which is critical for intent recognition and entity extraction.

d) Question and answer system:

Question and answer (Q&A) systems are integral to chatbots, enabling them to provide informative and interactive responses to user queries. These systems typically consist of a knowledge base or a database of information that the chatbot can access. When a user asks a question, the chatbot's Q&A system searches this repository for relevant answers and presents them to the user.

e) Output:

The suggested Artificial Intelligence-based system's performance is assessed and contrasted with industry-standard and cutting-edge techniques. The effectiveness of the system is assessed using evaluation measures like accuracy, precision etc. Figures are used to show the findings in order to give viewers a thorough grasp of the system's operation.

3. Conclusion:

In conclusion, chatbots based on artificial intelligence represent a remarkable advancement in human-computer interaction. These AI-driven virtual assistants and conversation agents have the potential to revolutionize customer support, streamline information access, and enhance user experiences across various domains. Their ability to understand natural language, maintain context, and provide real-time responses has opened up new avenues for businesses and organizations to engage with their audiences effectively.

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