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Chatbots: A Comprehensive Review of Functionality and Development

Sheetesh Kumar
Computer Science and Engineering
Chandigarh University
Mohali, India
siteshkumar950@gmail.com

Naman Kandhari
Computer Science and Engineering
Chandigarh University
Mohali, India
namankandhari03@gmail.com

Shubhang Mishra
Computer Science and Engineering
Chandigarh University
Mohali, India
Skshubhangmishra95@gmail.com

Anjul Chauhan
Computer Science and Engineering
Chandigarh University
Mohali, India
anjulchauhan24@gmail.com

Anmol singh
Computer Science and Engineering
Chandigarh University
Mohali, India
ms9570097@gmail.com

Netali Singla
Computer Science and Engineering
Chandigarh University
Mohali, India
singlanatali52@gmail.com

***Abstract*—Chatbots are electronic gadgets that respond according to the preferences of the user. It's widely used by people to get our questions addressed. A chatbot is a piece of software that uses technology to converse with users in their own language. It's also a sophisticated system that can answer your question right away from anywhere at any time. These days, the technology's responsive interface is the main reason why so many firms employ it. This paper presents the technology of chatbots and then provides an overview of the results. Chatbot technology is based on artificial intelligence (AI) and natural language processing (NL). We are highlighting the challenges and limitations of the ongoing work and making some suggestions for improvements or additional research.**

***Index Terms*—chatbot, chat script, conversational modeling, machine learning, artificial intelligence (AI), natural language processing (NLP), and technology.**

I. INTRODUCTION

A chatbot is an automated system that can have real-time conversations with humans. All websites make use of this modern technology to promote constructive human-to-human connection. They also think it's easy to use the website. They take in plain text input from the user and return the most relevant response. Many websites, including e-commerce and educational ones, often use chatbots. They provide users with access to a website where they can engage with the real issues and find fun solutions. These days, organizations employ chatbots extensively because of their ease of use, shorter processing times, and user-friendly design. The modern world is mostly dependent on technology, and because of its incredibly user-friendly design, chatbots have grown incredibly popular. Many e-commerce companies are experimenting with using chatbots to manage every facet of customer relations, and thus far, so good. What makes the chatbot crucial? This technology can be used anywhere, at any time, and responds very rapidly. Its interface makes it simple to use, and programmers can build with it because it takes less coding. These days, organizations employ chatbots extensively because of their ease of use, shorter processing times, and user-friendly design. The modern world is mostly dependent on technology, and because of its incredibly user-friendly design, chatbots have grown incredibly popular. Many e-commerce companies are experimenting with using chatbots to manage every facet of customer relations, and thus far, so good. What makes the chatbot crucial? This technology can be used anywhere, at any time, and responds very rapidly. Its interface makes it simple to use, and programmers can build with it because it takes less coding.

The domain-specificity, time constraints, and demand for manually written rules were the key downsides of the chatbot system's pattern-matching and rule-based models.

II. LITERATURE REVIEW

A chatbot is a new piece of technology that many organizations find highly useful in their daily operations. They grant us access to a plethora of other communication fields where chatbots are widely used, including digital learning technologies. In our work, we present a summary of the literature on the several filled fields. When we review a closing, we will make note of it. an assessment of chatbots with contemporary technologies. What mentors the chatbot needs to learn, explore, and apply its adaptive talents are the three main research concerns. For each of the three challenges, we outline possible directions for future investigation.

In 2020, Web developers will have a vast array of properties, frameworks, and tools at their disposal, but they will also be using or working on frontend development, which is growing at such a rapid pace that it will be difficult to keep up with the pace of expansion. They need to make it possible for end users to develop front-end apps without any programming knowledge, integrate them quickly with front-end coordinates, and use app development to improve back-end work services.

One of the main advantages of building mashups with the methods outlined here is the capacity to make observations that would not be possible with individual datasets.

It might be difficult to see a phenomenon as a totality because different entities may gather data that represent different aspects of the phenomenon. Our objectives include accessibility, convenience of use, and purpose. For example, both valid links and useful elements help return visitors to a pleasant website experience. The website was designed with simplicity in mind at the same time. We determined the percentage of studies that referenced each of the previously listed elements. For this study, we use a criterion of thirty percent. We created a shortlist of suitable website design research items that appeared in at least 35% of the investigations. .

III. BACKGROUND OF CHATBOT

As everyone knows, a chatbot is a text-based tool for human-to-human communication. Another term for a chatbot is a chatterbot. They have gotten instruction in understanding requests for a variety of languages and inquiries. For a very long time, humans have been communicating. Though we have created many devices in the last 70 years, chatbots, or more precisely machine-based technologies, have shown to be quite helpful in promoting human-machine connection. In 1950, Alan Turing became the first person to build a chatbot. After that, the chatbot experienced multiple changes and kept improving every day. Alan Turing poses the first question: ”Can Machines Talk or Think?” Additionally, he starts to exhibit Turning’s intelligent behavior, raising the possibility that he is a chatbot. Although this chatbot has a few mistakes, ELIZA was developed in 1966 as a reaction to Anal Turning’s chatbot. With its use of machine learning and lexical rules, ELIZA is a more advanced system. Though very little is known about these chatbots or programming, they interact with the user through specific terms that are akin to programming.

Since its initial application in chatbots in 1980, artificial intelligence (AI) has grown in functionality. A.L.I.C.E. (Artificial Intelligence Internet Computer Entity) operates on the Artificial Intelligence Markup Language platform. The restrictions on how chatbots can match and respond are set by the domain, or the rules that are specified for the domain. Every smart gadget and accessory contains technological aspects, such as a user interface, that are exclusive to the technology it employs. A multitude of technological features are frequently utilized in chatbots.

IV. APPLICATION OF CHATBOT

A. SpaCy:

SpaCy is a library designed primarily to assist engineers in developing an NLP system that can process and ”get” large amounts of text. Spacy can also be used for text pre-processing, data extraction, and NLU framework preparation for deep learning.

B. PyNLPl:

PyNLPI, or ”pineapple,” is a Python package for natural language processing. It could be useful for the creation of a basic language model, n-gram extraction, and repeating record extraction. There are modules and bundles in this library.

C. NLTK:

The Natural Language Toolkit is another term for NLTK. It is an assortment of open-source Python programming projects and libraries. Similar to WordNet, NLTK provides a set of text-handling modules for labeling, parsing, grouping, tokenization, semantic reasoning, and stemming that facilitate interaction with various lexical assets and corpora.

D. DeepPavlov:

Using Keres and TensorFlow, DeepPavlov is an open-source conversational AI library. With its array of adaptable and extensive tools, engineers and experts in natural language processing (NLP) may create conversational multi-expertise conversational colleagues that are ready for production. Python 3.6 and 3.7 are effectively supported by this module.

E. ChatterBot:

This Python module lets users engage in conversation with the program in an effort to improve programming. Additionally, it uses a range of AI calculations to provide different answers, which will help with the creation of chatbots and the automation of customer service.

F. PyQt5:

TextBlod, a Python package, is intended to handle printed texts written in the Python programming language. The package provides a straightforward API for the implementation of standard NLP tasks including object phrase extraction, feeling exploration, grammatical feature labeling, and so forth. This library is based on Python 2 and 3 and aims to provide a point of interaction.

G. Tkinter:

Python just needs Tkinter for the graphical user interface; once these are used, the user can access our chatbots and other resources.

V. THE USE OF CHATBOT

These days, chatbots are used by every type of business and organization because to their incredibly user-friendly and adaptable interface. Our work is now more faster and more organized thanks to chatbots. Bots are utilized in most fields.

A. The Education Sector:

These days, technology has also enhanced our educational system, and this organization also employs chatbots for a number of purposes. Easy-to-use information system: Universities and schools had separate message systems in the past, but chatbots are a good thing in the information area these days. Following COVID-19, chatbot usage has surged.

B. Corporate Sectors:

Chatbots are widely used in corporate marketplaces. There are a lot of companies in the industry providing information solutions that are actually chatbot-based. These include Infosys (support for Infosys), Apple (Siri), Amazon (Alexa), Google (Google Assistant), Flipkart (support for Flipkart), and many more. Chatbots have an easy-to-use interface and rely solely on contemporary technology; they also have a visually pleasing user interface.

C. E-commerce Industry:

There is a sizable market for these problems because the eCommerce industry operates internationally as opposed to domestically. Furthermore, because chatbots are an essential part of the operating system, they are widely used in this industry. They use chatbots on social media, emails, and phone calls to respond to customer inquiries.

D. Medical Sector:

Due to chatbots' great practicality for both patients and doctors, the medical sector is also utilizing them. A lot of duties are carried out by chatbots, including updating patient medical histories, confirming prescription invoices and clinic numbers, and much more.

VI. TABLE: CHATBOT DATASET

VII. THE TECHNOLOGY BEHIND CHATBOT

*A. **AI and NLP:** The basis of chatbots is a QA script; users respond by selecting buttons, and the developer has pre-programmed some code. Artificial intelligence (AI) and natural language processing (NLP) combine to power this chatbot. The only thing these engines—AL and NLP—need to do to reply is compile a list of keywords because they are already intelligent or trained. An organization can gain a lot from the features of the first kind of bot, which has already been trained to function. Make use of these features to save costs and time. Increase revenue and improve user satisfaction as well.*

These days, bots that use AI and NLP to improve customer experiences are becoming more and more common. Modern technology is used to train bots so they can perform better. The future of chatbots will depend heavily on AI and NLP, as they represent enhanced versions of the technology. Chatbots are using this technology to enhance their comprehension and response to customer requests.

TABLE I
CAPTION

CHATBOT	FEATURE	APPROACH	RATING (out of 5)
Netomi	NLU Engine, Reinforcement learning and ongoing optimization, Knowledge-base integration, Analytics, and real-time reporting. Multi-lingual, Omni-channel(email, chat,voice, social), and many more.	Netomi AI helps many companies automatically resolve customer queries via chat, voice, e-mail, and messaging. It can automatically resolve over 65% of customer queries without human involvement.	5
Microsoft Bot Framework	AI and natural language, integrate with the existing IT ecosystem, Speech capabilities, Open-source SDK, and tools to build.	Microsoft Bot framework for building conversational AI experiences. The Microsoft bot framework allows users to use a comprehensive open-source SDK and tools to connect with other channels.	4.6
Zendesk Answer Bot	Multilingual, Deep learning, Integrates with Zendesk Guide knowledge base, Integrates within Zendesk agent desk platform for the seamless human hand-off.	Zendesk Answer Bot is used to answer incoming customer questions right away. Zendesk knowledge base provides the customer with the information they need without delay.	4.6
Alexa for Business	SDKs for Node.js, Python, and Java, Transactions and closed-loop commerce, and Self-service APIs to help you create, manage, test, and publish custom skills.	Amazon AI (Alexa) captured 75% of the market, Alexa is the best AI chatbot software for voice assistants. With Alexa for Business, the IT team can create or customize the functionalities.	4.4

*B. **Tools for E-commerce:** Since most e-commerce companies use technology to improve customer experience and increase sales of a range of products, a chatbot is a very useful tool.*

E-commerce website: Most e-commerce companies today use this technology because of its user interface. Businesses can swiftly draw in more customers and save time by utilizing chatbots to promote their products.

Hospitals: Chatbots are used in hospitals to make appointments, among other things. Because these features reduce the

need to wait in a queue, patients find them especially enticing.

Restaurants: Reservations are made in the restaurant via a chatbot.

*C. **Voice activation technology** Because it takes less time to operate, chatbots have become more and more popular after a new feature called "Voice assistant" was included. Users are more interested in using voice assistance than text input. Voice assistant-equipped chatbots are being developed by numerous prominent participants in the market, such as Amazon, Google, Microsoft, Apple, and numerous more.*

*D. **Interoperability:** Chatbots can now function independently across multiple platforms, but some companies are working to make them more interoperable. A feature called interoperability enables consumers to work together with chatbots that are connected from various platforms. With the addition of these features, the chatbot will be able to carry out tasks more rapidly and effortlessly. An interoperable chatbot may remind me to buy or compare the product on another platform when I choose to buy anything from a different website.*

VIII. How Chatbot works

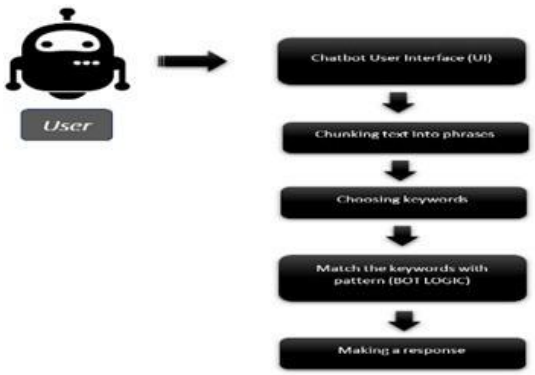

Fig. 1. Workflow of chatbot

IX. Conclusion

In this work, we have reviewed a chatbot; the review paper is based on chatbot design and describes the system. We offer further information about their functionalities and characteristics. Applications for chatbots can be found in many different areas, such as manufacturing, banking, and education. We also enumerate the limitations and challenges of the modern world. Despite technological advancements, bots are still able to mimic human speech. result of inadequate modeling and unfettered access. Additionally, trained AI chatbots are not. It is possible to apply this kind of idea to numerous other firms. This kind of research authorization allows for a greater variety of more believable outcomes. The truth is, it might be difficult to tell a chatbot apart from its clones. A noteworthy project that mixes deep learning is chatbot modeling.

Since they think chatbots should only be used for texting, many individuals are happy with how well they perform. This is a totally untrue misconception, though, as chatbots today carry out a wide range of human-performed jobs, such as engaging with people and giving feedback.

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