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A Modern Tool of Conversation: Chatbot

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Abstract

A chatbot is a work of artificial intelligence technology that simulates a conversation (or chat) in natural language with a user via messaging applications, internet sites, smartphone apps, or the telephone. Chatbots are used in a range of conversation systems for a variety of purposes, including customer assistance, request processing, and information acquisition. Chatbots have been around for quite some time, but it has only been in the recent past few years that they have seen a significant uptick in popularity among consumers and companies. This change in the perspective of chatbots and conversational interfaces was heavily impacted by the advancements in artificial intelligence and machine learning, as well as by the expanding usage of messaging app technologies. This study offers a comprehensive analysis of the conversational tool known as chatbots, which emerged in the contemporary era. This paper also discusses how this tool is expanding its root in the life of human beings as well as the pros-cons that will be generated by the chatbots.

Keywords: Chatbot, conversation tool, chatbot utilities, security issues

1. Introduction

Michael Mauldin invented the term "ChatterBot" to describe conversational algorithms back in 1994. Using pattern matching, a chatbot identifies a predetermined response based on user input. Saying, "What is your name?" to the bot is an example of this. Even the machine can comprehend. When given a statement like "My name is Chatbot," the chatbot is most likely to react with "You may call me Chatbot." After the database stores the user's input, a response is sent to the user according to a predefined pattern. If the sequence of a sentence is determined and an existing response pattern is utilized to adapt to the phrase's unique characteristics, the Chatbot may be created. In addition to not being able to register and answer complicated inquiries, they also cannot complete complex activities. The chatbot performance and purpose may be analyzed by evaluating how chatbot encounters live up to

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expectations and how chatbot services compare to alternatives. Increasing accessibility to chatbots should be expected now that they are available on mobile devices. The number of mobile chatbot apps, as well as chatbot functions in communication platforms like Facebook Messenger, Slack, Telegram, and Skype, has rapidly increased. Most chatbots are accessible through popups or virtual assistants on websites. They may be characterized as commerce (e-commerce through chat), education, entertainment, finance, health, news, and productivity [1]. Nowadays, many firms utilize chatbots instead of humans. Most of the time, such systems are based on how ELIZA or ALICE communicates. Figure 1 represents a few widely used applications of chatbots.

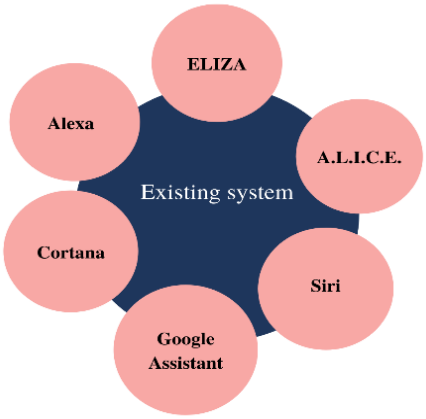

Figure 1. Present Chatbot Applications

1.1 Eliza

In 1950, Alan Turing released his now-famous paper "Computing Machinery and Intelligence," in which he suggested the Turing test as a measure of intelligence. Based on the judge's inability to tell the difference between a computer program and an actual person on the basis of the conversational content alone, this standard measures how well a computer program can mimic human speech in real-time text conversations. A great deal of interest in Joseph Weizenbaum's 1966 software ELIZA arose as a result of the scandal surrounding Turing's proposed test. As a result, the program's discourse is quite similar to that of a human being. ELIZA's functioning revolves around the detection of clue words or phrases in the input and the subsequent production of the related pre-prepared or pre-programmed replies.

1.2 A.L.I.C.E. (Artificial Linguistic Internet Computer Entity)

It is a chatbot that uses heuristic pattern matching to converse with users in any language. In the year 1995, Richard Wallace was the first to construct ALICE by himself and

his team. Because it was the first software to run on an Alice computer, it was originally known as Alicebot. Dialogue rules are established using the XML standard for AIML (artificial intelligence markup language). Wallace released an AIML specification in 2001 after the program was rebuilt in Java in 1998. Later, other programmers and translators adapted ALICE for use in a number of programming languages and languages other than English.

1.3 Siri

Siri, Apple's AI-powered assistant, and learning guide, was launched in 2010 for iOS. Artificial Intelligence (AI) personal assistants owe a debt of gratitude to this first generation of personal assistants. Text, music, images, and video may all elicit a response when the user directs it to do so.

1.4 Google Now/Google Assistant

Google Now was launched in 2012 by Google Inch. It responds to questions, performs activities through web service requests, and gives advice. To compete with Apple's Siri, it was included as part of a package of mobile search enhancements and UI adjustments. With the launch of Google Assistant last year, the previous version of Google Now was phased out. As part of Google's new, more aggressive growth strategy for search, the assistant has been included. The idea is simple that, Google wants to provide you with information before you even know you need it.

1.5 Cortana

Microsoft first unveiled Cortana at its Build developer conference in 2014, and it has since been incorporated into two very different Windows Phone and Windows 10 PCs. Speech recognition and relevant algorithms are used to reply to voice instructions in this application. Setting reminders, sending emails and messages, making and maintaining lists, conversing and playing games with Cortana, and looking for facts, places, and information are just a few of the activities that may be performed by Cortana.

1.6 Alexa

Alexa is a smart helper created by Amazon. Originally unveiled in 2014, it's currently found in a variety of Amazon products, including the Echo Show, Echo Dot, and Echo Show Mini. Other third-party manufacturers are releasing Alexa-enabled devices and an app. You

may ask her to play music or to discover an Italian restaurant by just saying "Alexa." and she'll do the rest for you.

An overview of cloud-based chatbot technology, as well as programming and development challenges in the present and future periods of chatbots, have been discussed in [2]. Authors in research [3] have presented a comprehensive literature analysis that looks into the sectors of education where chatbots have previously been implemented, as well as the pedagogical responsibilities of chatbots, their usage for mentoring, and their potential to customize education.

2. Different Types of Architecture Models of Chatbots

The architecture model of a chatbot is chosen based on the primary purpose of development. A chatbot may respond in one of the two ways: it can accept replies in a predefined form or it can construct an answer from base using machine learning models. All AI chatbots are actually capable of satisfying consumers' expectations since they can give a regulated user experience. Almost every company is striving to build tailored interactive AI chatbots for their company. A Chatbot can be of several sorts. Figure 2 depicts some of the methods/systems for developing a chatbot.

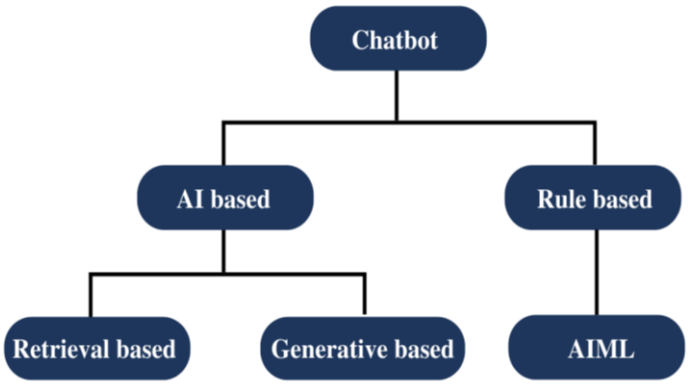

Figure 2. Overview of Chatbot

2.1 Retrieval-based models

These models are easier to build and produce more reliable results. Although these may not usually offer appropriate answers, the replies need to be verified for grammatical problems. These are more practical because developers have access to a diverse set of algorithms and APIs. To offer the optimal answer from a prepared selection of texts, this bot

analyses the message and context of the discussion as shown in Figure 3. It is ideal for customer service, lead creation, feedback, order placement, and so on.

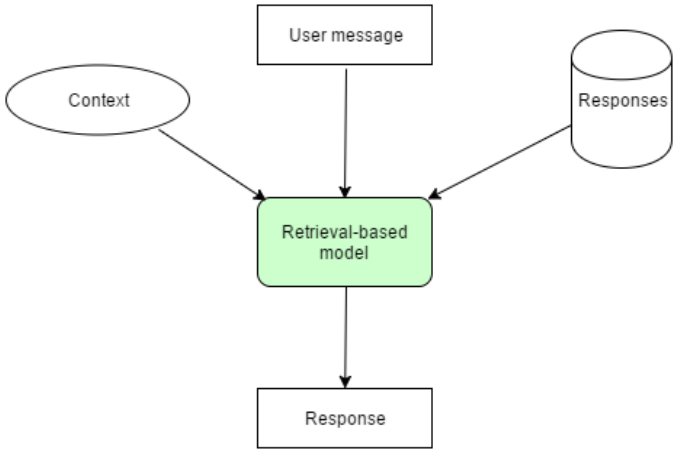

Figure 3. Retrieval model architecture [8]

2.2 Pattern-based heuristics

A response can be created using either if-else conditional logic or machine learning classifiers. The most straightforward approach is to construct a collection of rules with predetermined patterns that serve as the condition for the framed rules. The Artificial Intelligence Markup Language (AIML) is commonly used to write patterns and responses in chatbots. Developers utilize both these languages to write code that can contain many units. When a developer gets a message, they search across all the patterns until they find one that either perfectly matches or comes near to the user message. If a match is found, that template is used to construct the answer. ChatScripts are a more recent implementation of this kind. It is an open-source chatbot engine that allows defining a chatbot in a rule-based language.

ChatScript Template:

<category>
<pattern>What is your name</pattern>
<template>My name is Vidhi</template>
</category>

2.3 Generative models

These models will be used to build future chatbots, giving them more intelligence and interactivity. A generative chatbot is a chatbot programme that produces novel language combinations rather than picking from pre-defined replies as shown in Figure 4. Seq2seq machine translation models may be used to construct generative chatbots.

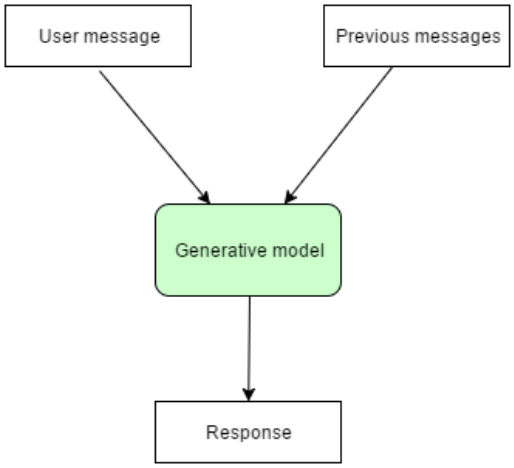

Figure 4. Generative model architecture [8]

3. Chatbot and We

Nowadays, chatbots are widely used in almost all sectors' online interfaces. This section describes how this modern-age conversation cum assistance tool is used in domains such as e-commerce, education, healthcare, etc.

3.1 Chatbots in E-Commerce

Apps, email, and social media are all options for making an online transaction. Customers may become confused by the numerous options if there isn't a single clear path to enterprises. On many channels, such as Facebook or their online store, businesses can utilize chatbots to rapidly connect with customers and fix their difficulties.

Customers may interact with an eCommerce chatbot at every point in their shopping experience because of the power of AI. Conversational commerce isn't just a great notion; research reveals that people are more willing than ever to shop with bots online. As a result of intelligent suggestions, they may turn visitors to a retailer's website and app into engaged prospects. Online shoppers are often looking for discounts and deals. As soon as a prospective customer inquires about any discounts or special offers, an e-commerce chatbot may present them with discount coupons or direct them towards such offerings. In addition, customer care after the transaction is crucial to establish a long-term connection with a client and promote repeat purchases. As far as internet companies are concerned, chatbots are a godsend in this regard. Customer discontent stems from the amount of time it takes to get through to a customer care representative through conventional channels like call/email. The long wait times in e-commerce may be alleviated by using chatbots. They don't have set "office hours", so customers may reach them at any time with problems or questions. Also,

because they do not need to keep a huge customer service team, e-commerce firms can save a lot of money on their operational expenditures.

3.2 Chatbots in the Healthcare Domain

Now, chatbot algorithms are being built using large volumes of healthcare data, including diagnosis and treatment options. Public datasets, such as COVIDx for COVID-19 diagnosis and the Wisconsin Breast Cancer Diagnosis, are continuously used to train chatbots. Artificially intelligent conversational chatbots may answer to user inquiries by utilizing pre-defined labels derived from the training data. Medical facilities are using chatbots to find doctors, clinics, and pharmacy hours that are suitable for patients. For example, patients may use a chatbot to describe their current health conditions, select the correct doctor or dental professional to treat them, locate available appointment times, and make, reschedule, or cancel appointments. Medical appointment reminders and updates may also be provided via chatbots that are integrated into users' calendars. Chatbots may be elicited with simple inquiries about the patient's name, location, symptoms, current doctor, and insurance information. Medical facilities may use chatbots to save this information and make it simpler for patients to be admitted, their symptoms tracked, doctors and patients to communicate, and records kept for future reference [5,6].

3.3 Chatbots in Education

The use of educational chatbots in the classroom has the potential to revolutionize how schools interact with their pupils today. Students may now discover more about their choices and activities at school in a more convenient manner than ever before, as shown in Fig 5.

Figure 5. Chatbots in Education [3]

Chatbots provide students with a customized learning experience by evaluating responses, tracking how they navigate through study content, and so on. Chatbots, a multipurpose artificial intelligence tool, can be used by students to study. A lecture can be transformed into a sequence of messages to resemble a regular chat session. The bot may check and analyze the student's level of knowledge on a regular basis and adjust the learning accordingly.

3.4 Chatbots in Travelling Domain

The capacity to provide 24/7 customer support is a key feature of AI chatbots for hotels, airlines, restaurants, and car rental companies. An AI chatbot will be eager to reply to basic questions quickly and at any time of day. In contrast to human workers, chatbots do not need to be paid nor do they need to be rested while they are working [7]. A hotel bot, for example, can be available at all times, even when receptionists or customer care representatives are unavailable. More direct bookings can be encouraged with the use of a chatbot, which can improve financial results. Chatbot technology can be used on a company's website, social media sites, and messaging platforms to give users direct booking alternatives and send these messages at the proper time, increasing the odds of success. AI-powered bots can identify and translate languages fast, and they can respond to customers in the same language. Chatbots can also learn more languages than human workers, which is a huge advantage. A chatbot may store information about individual customers and then use that knowledge to improve the quality of its recommendations. What happens next depends on whether the chatbot asks follow-up questions or clarifies preferences before providing suggestions.

4. How much chatbot is helpful?

The term for chatbots is known as virtual assistants. Basic artificial intelligence software that mimics human speech is included in the package. Chatbots may be studied and improved. In addition to classrooms and offices, it may also be utilized for business meetings and online chit-chat [4]. It may be used in the classroom as a teaching tool. The data needed for schooling can be saved in a database and retrieved at any moment by querying the bot. In the business world, it can be used to efficiently supply business solutions. When the solutions are effective, the business can improve and the company's growth can accelerate. Chatbot can be used for enjoyment in internet conversing. When people are bored, they can converse with these bots online for entertainment purposes. Using these bots to learn a new language is

possible in a plethora of ways. To learn a new language, you may just ask the bot a question about it. In the medical profession, they may also be used to tackle health-related problems. Table 1 summarizes the various advantages and disadvantages of this conversation tool.

Table 1. Analysis of Chatbot utilities.

Challenges	Benefits
Chatbots can fail when dealing with an unsaved query since the database utilized for output generation is fixed and limited.	Chatbots can provide more personalized experiences than customer care representatives since they can access your previous interactions with the organization to provide a tailored experience.
Because chatbots are unable to handle many inquiries at once, interaction options are limited.	They can work in a variety of languages, which is particularly important for multinational brands. Conversational bots may either ask a user which language they prefer before they begin their conversation, or they can learn the user's favorite language from their input words.
To train chatbots, they need a lot of conversational data.	Bots can do actions like altering or querying records almost instantly, which can greatly increase customer satisfaction.
Because of chatbots' poor comprehension, some consumers, particularly those from older generations, feel uncomfortable with chatbots, which makes it evident that their requests are being handled by machines, as is common with technology-driven modifications in existing services.	Consumers may rely on its availability even on the weekends and at nighttime. It doesn't care whether there are a lot of requests. All of these may be dealt with simultaneously by a bot without exhaustion. Maintaining a 24-hour response system ensures that the seller and the client are in constant contact.

The rise of chatbots is just around the corner, and they have the ability to take over the world. Users can benefit from chatbots in a new and flexible way. They're giving AI something to do that's more useful. Chatbots enable intelligent dialogue and are progressing at a breakneck pace with each new breakthrough. Contextual data is typically stored in chatbots and can be used to determine a geo-location or a state (which data is required for which stage when conversing with a bot?). This might be a phone number or other personal information, and no one knows if the information is encrypted before being saved to a database. It's difficult to picture a world without a Chatbot because it predicts and offers accurate solutions to presented questions.

5. Security aspect of Chatbots

People prefer to communicate with their devices rather than with other people in person. Alexa and Siri are two examples of machines that have begun to respond. Businesses are already recognizing the benefits of chatbot services and incorporating them into their networks, resulting in a more effective and simplified user experience for consumers across many channels. Chatbot security is becoming a rising concern as the technology grows in popularity. Categories that can be used to describe all chatbot security risks are threats and vulnerabilities: threats such as impersonation of individuals, ransomware, malware, data-theft, data alterations, re-purposing of bots by hackers, phishing, and whaling; and vulnerabilities such as unencrypted communications, back-door access by hackers, lack of HTTP protocol, absence of security protocols for employees, and hosting platform issues [9].

Systems can be safeguarded against chatbot security issues in four different methods. These consist of encryption, processes and protocols, authentication, and education.

1. End-to-End encryption: It implies that the discussion can only be accessed by the sender and receiver, making it secure. The GDPR's obligations include the duty that "firms undertake exceptional steps to de-identify and encrypt personal data". End-to-end encryption is thus essential to comply with GDPR laws.
2. Authentication: It refers to the processes used to validate a user's identification, which are necessary before granting access to any site. Methods such as biometric authentication, two-factor authentication, user ID, authentication timeouts could be used.
3. Processes and Protocols: The HTTPs protocol is the default configuration for any security system. The most important thing to understand about Chatbot security is that, while Chatbots are new, the protocols, methods, and software used to safeguard them are nearly comparable to those used in current HIMs. They communicate across platforms that already have their own internal security systems, and there is more than one layer of encryption and protection in place to safeguard consumers from the start.
4. Education: Human error education is critical since it is a major element in cybercrime. Hackers may readily enter the system since it is fundamentally faulty, and users are unaware. Although the necessity of combatting cybercrime has been highlighted in recent years, consumers and employees continue to be the most error-prone groups. A security concern will persist until everyone is trained how to use conversational

chatbots safely. It also boosts the clients' confidence in the security of the chatbot system.

6. Conclusion

People and services may communicate more easily using chatbots, which improves customer satisfaction. At the same time, they provide businesses with new alternatives for increasing customer participation and productivity improvement by decreasing the regular cost of customer assistance. Predictive analytics-based real-time conversations will be the future of chatbots, as opposed to basic user-based inquiries today. The success of a chatbot solution depends on its ability to do both these tasks correctly. Circumstances such as, setting up, training, and improving any chatbot system, requires human involvement. Chatbots improve lives by providing amusement, saving time, and resolving the most vexing problems. Building a chatbot might be challenging due to the wide variety of designs and techniques available. All researchers must agree upon a Chatbot's design. The chatbot should be simple to comprehend and have a limited knowledge base. Chatbot design is still in its infancy, and work must be done in order to find a common technique for creating one.

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