



## INTELLIGENT CONVERSATIONAL CHATBOTS: HISTORY, TAXONOMY, CLASSIFICATION WITH PRISMA MODEL

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**Abstract.** The ability of machines to think intelligently like a human is known as artificial intelligence (AI). AI advancements have enabled machines to mimic natural intelligence and make decisions like a human. AI and Human-Computer Interaction (HCI) paradigms are used to design and construct intelligent conversational chatbots. The Chatbot is defined as a computer program that would be intended to emulate dialogue among humans, particularly over the web. In this article, the PRISMA Model is used to provide significant scientific articles published from 1950 to 2022 on Intelligent Conversational Chatbot evolution, techniques, and classification. The objective of the article is to describe the current intelligent conversational chatbot approaches that were in use and represent their comparison based on techniques, drawbacks, and applications. Chatbots have the potential to enhance human-machine interaction.

**Keywords:** Chatbot, Natural Language Processing, Pattern Matching, Task-Oriented, Non-Task Oriented.

### 1 Introduction

Artificial Intelligence (AI) plays a significant role in our day-to-day activities in various domains like Machine learning, Deep learning, Robotics, Expert systems, Fuzzy logic, and Computer Vision. A chatbot is a common type of AI system or a program. An intelligent Human-Computer Interaction (HCI) is a model that studies how humans utilize computers to complete specific jobs and how they effectively interact with each other [1]. A chatbot is also known as chatterbot, multipurpose virtual assistants, smart bots [2], digital assistant, interactive

agent, conversational agent, and the artificial conversational entity that is described as hardware like Alexa Digital Assistant by Amazon Echo or software on Android devices, Google Assistant is available, while on Apple devices, Siri is available [3].

A chatbot can be defined as a program that uses Natural Language Speech to have a conversation with a human being. Chatbots are typically designed to perform a certain activity for which they have been trained specifically, which can include a diverse set of tasks such as arranging records on a workstation, browsing the web based on the keyword, and scheduling appointments. [4].

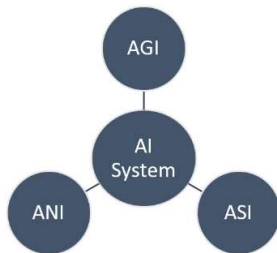
The research article attempts to present the recent research articles regarding Intelligent Conversational Chatbots Techniques, and their evolution over the ages, significantly from 2001 to 2021.

Further, this article is structured as follows: The history of Chatbot and its research avenues are outlined in section 2. Section 3 presents the different categorizations of the surviving chatbots and their general architecture. Section 4 presents a discussion on the standard design methodologies of chatbots. Comparison of chatbots technique using PRISMA Model was carried out in section 5. Section 6 presents the research gaps identified along with the future enhancement of the research.

## 2 Background

### 2.1 Artificial Intelligence

Artificial Intelligence (AI) is the simulation of human intelligence by computers that are programmed to think and act like humans.



**Fig. 2.1** AI Categorization.

AI systems are categorized into three types as shown in Figure 2.1, First type is ANI, which stands for Artificial Narrow Intelligence or narrow AI. It's the ability of a computer to excel at a specific activity. The second type of AI Technologies is Artificial General Intelligence (AGI) expects the machine to be just as clever as a person do. It does a task that a human can do more effectively. The third type of AI Technology is ASI (Artificial Super Intelligence), which refers to artificial intelligence technology that will ultimately match and exceed the human brain.

### 2.2 Machine & Deep Learning

Machine Learning (ML) is an AI technique, which learns based on the experience of a human.

Human beings learn things by;

1. Making mistakes. Someone corrects the mistakes and then learns.
2. During the learning process, the human brain is constantly getting inputs and neurons are being adjusted and new pathways are being created, which leads to a certain output or a decision.

Computers can be instructed in a similar manner, where neurological models are generated and they will be skilled with a large amount of training data. Then the expected outputs are modified, and the neural network can become provided with the training. So that, when a human gives new input to the computer, later on, it will recognize it. It can determine accurate results. There are other techniques where we use the knowledge present in available data, extract it, and use that knowledge to make future decisions.

### 2.3 Chatbot

A chatbot is computer software, algorithm, or artificial intelligence that interacts with a human or with another participant in the conversation via a messaging application or similar text application [5]. Sometimes it is also referred to as a chatterbot or chatter robot [6], They are capable of comprehending a variety of questions posed by humans [7]. They can also distinguish between the novelty of sentences and even emotions. They require a rich lexicon of communication among individuals to obtain the greatest quality of Chatbot conversation [8]. A conversational chatbot is a computer program intended to converse with humans using NLP (Natural Language Processing) [9]. The most challenging issue in Chatbots is keeping up with the conversation's context and interpreting human emotions. Current chatbot creation strategies include the use of a pattern-matching methodology and then creating pre-configured responses that fit the provided input. The disadvantage of this approach is that it does not always result in a meaningful chat that leads to the intended outcome [4].

### 2.4 History of Chatbot

In 1950 *Mind – Journal*, The Turing Test ("Can machines think?") was introduced by computers can this time and the idea of a chatbot gained traction [10]. Joseph Weizenbaum created ELIZA - the first chatbot [5] at Artificial Intelligence Laboratory, MIT LAB in the year 1966. It is made with a basic handcrafted script [11]. ELIZA is software that allows for natural language dialogue with a computer [12]. ELIZA utilizes pattern matching as well as a template-based answer selection mechanism. Knowledge is restricted in the ELIZA chatbot, because of this disadvantage ELIZE can't discuss a huge range of topics [2].

Parry [11], like Eliza, uses a rule-based approach, but with a deeper knowledge of the mental model that might elicit emotion. As a result, Parry is the first chatbot to include emotion in its design. ALICE (Artificial Linguistic Internet Computer Entity), a scalable chatbot that uses Artificial Intelligence Markup Language, is also worth mentioning (AIML). ALICE is a natural-language conversational agent. ALICE, on the other hand, and other chatbot systems are limited to the knowledge that has been crafted in their files. [13] As a result, ALICE continues to adopt a rule-based technique to acquire the response, repeatedly invoking a pattern-matcher. In 1972, PARRY was written at Stanford University by psychiatrist Kenneth

Colby. It attempted to imitate a person suffering from paranoid schizophrenia. It was dubbed "ELIZA with attitude" because it used a more advanced conversational style than ELIZA. In the 1970s, a group of psychiatrists used a form of the Turing test to examine a combination of actual patients and computers running PARRY. The test transcripts were sent to another group of psychiatrists to distinguish between human and computer responses, and they were able to guess 48 percent of the time correctly [14].

In 1983, Racter Chatbot was built by William Chamberlain and Thomas Etter for the Inc Corporation. Z80 microprocessor having 64K of Main memory was used to build the Racter Chatbot, which is hardware that is incomparable to today's technology [15].

Jabberwacky is a 1988 AI software that was one of the first attempts to create an AI program that could simulate human interaction and keeps on a discussion between users. It was primarily intended as a kind of amusement. Its goal was to changeover from a text-based system to one that was entirely voice-controlled [14]. CLEVERBOT or JABBERWACKY are two effective conversational chatter handlers [9].

SHRDLU was another version of chatbot developed in the year 1971. Parsing, grammatical detection, and semantic analysis are the techniques used to create a chatbot [16]. A graduate from MIT named Terry Winograd worked at SHRDLU from 1968 to 1970. It was a computer system that could recognize basic English phrases and carry out orders in English talks. People could send commands to handle items, and the system would ask for explanations if its heuristics programs couldn't decipher a language based on context and physical knowledge (Winograd 1971) [17].

Dr. Sabaitso ("Sound Blaster Artificial Intelligent Text to Speech Operator") in 1991, a chatbot took advantage of a technologically revolutionary innovation - Creative Labs' Sound Cards. It grew added humanistic than just its predecessors in some ways because it can imitate dialog - it communicated vocally [15].

ALICE ("Artificial Linguistic Internet Computer Entity") was a chatbot based on ELIZA that existed from 1995 until 2000. [18] The Artificial Intelligence Markup Language was also used to create ALICE (AIML), which has a structure that is quite close to that of today's current solutions [1][19-21]. It's an NLP chatterbot that uses systematic pattern-matching techniques to imitate conversation, however, it failed the Turing test. ALICE is built on the foundation of XML knowledge bases [14].

SmarterChild is the next chatbot in its evolution and it was made available in messaging applications [22]. ActiveBuddy was created in 2001, and it was extensively diffused over worldwide instant messengers and SMS networks. It was a forerunner of Apple's SIRI and Samsung's S VOICE since it provided a lively, personalized dialogue [14].

StudyBuddy and SmarterChild were launched in the AIM context, both of which can communicate with people in non-formal training to assist them. The app offered discussion boards where members of the online community may speak in addition to effective engagement [18].

Watson is a question-answering (QA) computing system that applies modern NLP, retrieval of information, expert systems, task-specific algorithms, and machine learning technologies to the domain of open and distributed query answering. Watson was created by IBM in 2006. Watson uses IBM's Deep Quality Assurance software as well as the Apache UIMA framework (Unstructured Information Management Architecture). It runs on the SUSE Linux Enterprise

Server operating system and leverages the Apache Hadoop framework to facilitate distributed computation [14].

The development of virtual personal assistants, such as Apple Siri [1] also called Cortana [20], was the next stage. It is an example of voice-based task-oriented chatbots/conversational agents that try to respond to the task they have been given. In confined areas, task-oriented chatbots operate effectively [23].

Google Assistant/ Google Now (IPAs - Intelligent Personal Assistants) [24] is a type of virtual personal assistant. [1] It makes suggestions for locations people might want to visit, and Tesla can drive us there [25]. It was invented by Google for Google's mobile search applications. Android 4.1 ("Jelly Bean"), which was released in 2012, was the first to have it. By delivering queries to a series of web services, it used a natural language interface to answer inquiries, offer recommendations, and forecast actions. Google also created Google Assistant, a smart extension of Google Now that participated in two-way communication with the user [14].

Mitsuku is an AIML-based chatbot [4]. Steve Worswick built it using AIML to comprehend and respond to people. Her capacity to reason with certain items is part of her intellect. She has won the Loebner Prize twice, in 2013 and 2016, and was runner-up in 2015 [14]. It provides web-based services [26].

Microsoft developed Cortana Chatbot [27]. Microsoft Cortana assists us in resolving everyday issues such as finding restaurants, places, and more. It focuses on a single task and does it well [28].

Amazon Alexa [1] is a digital tool existing as hardware. [3] It is a voice-based task-oriented chatbot [23]. Because of its natural language contact with people, it strives to assist humans by delivering information or doing specified jobs for them. These systems are designed to address two distinct but connected issues: (a) natural language comprehension and (b) conversation flow management (dialogue). Different frameworks have been built based on the two mentioned difficulties. These platforms offer researchers methods capable of dealing with the issues mentioned, allowing them to create Virtual Assistants and chatbots for specialized areas [24].

Bots for Messengers - Facebook developed a chat framework in 2016 that allows programmers to construct bots that could communicate with Facebook users. M bots were ready by the end of 2016, spanning a wide variety of use cases [14].

Microsoft released Tay, an experimental artificial intelligence chatbot, in 2016. Tay was terminated after a day due to their profane and offensive tweets, contacts, and interactions with people on Twitter [5]. Microsoft introduced Tay to the public on March 23, 2016. During Tay's brief public existence, the bot sent out over 93,000 tweets [5]. 'Thinking about you is abbreviated as Tay [15].

## **2.5 The Taxonomy of Chatbots**

Chatbots are often classified as, task-oriented and non-task-oriented chatbots. Task-focused chatbots are meant to do certain tasks depending on the user's instructions, whereas non-task-oriented chatbots have several functions as in figure 2.2 and figure 2.3.

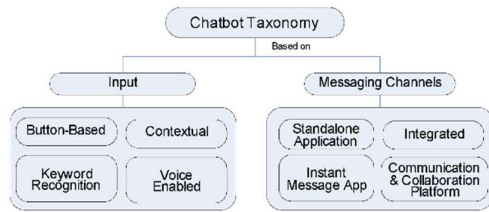


Fig. 1.2 Taxonomy of Chatbots.

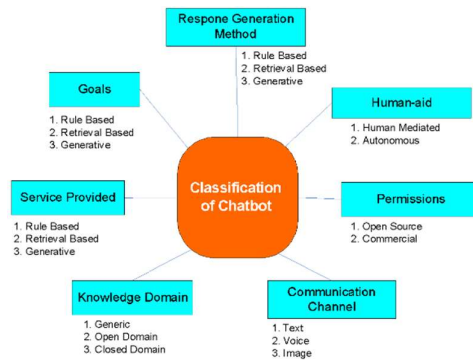


Fig. 2.3 Chatbot Classification.

## 2.6 Applications / Use of Chatbots

An intelligent Agent is a computer conversation system that uses natural language to connect with humans [29]. Chatbot mechanisms have driven new possibilities for a wide range of industries. Chatbots are implemented in educational domains, not just to improve the interactive skills of the students but also to aid instructors, in such a way by providing computerization. Virtual assistants in education improve connectedness, efficiency, and interactions by reducing uncertainty. It can easily provide a virtual learning atmosphere that is focused, personalized, and outcome-based, which is exactly what today's modern academic institutions want. If an institution of higher learning utilizes a chatbot to connect with students, the application's first mistake rate is quite high [18]. Education Environments, Customer Service/Support, Health, Robotics, Industrial Use Cases, Ticket Booking, Instant Query Solutions, Gathering Feedback, Email Listing, Friendly Conversation, Marketing, and sales.

## 3 Related Works

An intelligent chatbot tends to improve its efficiency through conversations all the time. The chatbot modules which include user simulation modules and the module for understanding the natural language will work better through continuous interaction and learning processes. Algorithms of machine learning (ML) and human supervisors enable the chatbot to be trained properly. To ensure that the AI chatbot becomes a successful learner, ML methods such as supervised reinforcement learning and unsupervised methods can be leveraged. Chatbots can become successful learners with neural networks and deep learning. This study aims to analyze and investigate the earlier chatbot surveys that were conducted previously.

A systematic review on “Chatbot: History, Technology and Applications” by Adamopoulou,

Eleni, and Moussiades, Lefteris [2] explains the history of chatbots in detail with the technology used. The key objective of the survey was to present the existing chatbot types and the approaches for developing a chatbot. A chatbot may be created using computer languages such as Java and Python, as well as a commercial or open-source chatbot creation environment. Chatbot usage comes with several risks, the most significant of which is concerning the security of personal data. Protective techniques are now being studied in this area. The most severe problem they now have with chatbots is their incapacity to understand and generate natural conversations. They may occasionally become unable to interpret a term, resulting in communication breakdowns and tense interactions with their interlocutor. The most essential stage in the ongoing development of chatbots is to improve language understanding and output. According to Eleni Adamopoulou and Lefteris Moussiades, the quantity of chatbot-related technologies is out of control, and it is getting worse every day. Chatbots may be created using a programming language like Java, Clojure, Python, C++, PHP, Ruby, Lisp, or cutting-edge platforms. The knowledge area, service, as well as objectives, input processing, response production technique, human aid, and chatbots can be classified based on a variety of variables, including their creation process. The study has listed and explained the Concepts associated with chatbot technologies: Pattern Matching, AIML, LSA, Chat script, RiveScript, NLP, NLU, entity, and finally contexts [1].

The Survey "Development of Conversational Agent to Enhance Learning Experience" by Nor Hayati Jaya et al [31], aims to evaluate the use of chatbots and explained the importance of NLP Techniques that will be used in designing a chatbot. The study highlighted the important components: Basic input processing; Input Understanding; Dialogue Manager; Knowledge Base; Response Generator and output. The author opined that the majority of students use chatbots for learning purposes. A chatbot helps immensely in the teaching-learning process especially for students because it gives instant messages and responses to the user. Besides this, based on the student genders, there is no significant difference towards the conversational agent. The study focuses largely on the usage of Chatbots in higher education institutions for teaching and learning, with less attention paid to other forms of education: such as healthcare, sociology, and so on.

Jan Deriu [32] proposed the classification of characteristics of the various types of intelligent conversation systems based on Task-Oriented, Conversational Agents, and Interactive questioning and answering. This article also concentrated on efforts to automate the conversation system's evaluation procedure.

Divya S et al. [33] describe Chatbots as Software that communicates with people in natural language. Even though every chatbot has a unique field of specialty, this approach is the same as other kinds of chatbots. One input from a human is matched against the chatbot's knowledge base. Chatbots rely on artificial intelligence to function.

A study conducted by Erika Bonnevie et al. [34], elaborates on the requirement for considerable finance to continue traditional media buys, community-based programs that leverage expensive mass media techniques as a core tactic may face hurdles in ensuring long-term sustainability.

The authors of "AI-Powered Health Chatbots: Toward a General Architecture" present a robust Structure of an Intelligence Medical Bot with four factors to accomplish two objectives that integrate conversation and interaction aspects in natural language understanding (NLU) and

natural language generation (NLG), as well as a supervised neural expert portion that provides adequate answers from pre-formatted information [35].

A study from [36] “Conversation Technology With Micro-Learning: The Impact of Chatbot-Based Learning on Students’ Learning Motivation and Performance” by Jiaqi Yin et al. expressed that research has a lot of potential for the future development of chatbot-based micro-learning systems with varying levels of interactivity. The influence of a chatbot-based micro-learning system on students' learning motivation and performance was explored in this study.

Adam et al. conducted an online study to prove how verbal humanities promote better and the finger technique both increase user participation when a chatbot requests customer comments [30].

Florian Brachten et al. created a model, which is based on the deconstructed ‘Theory of Planned Behavior. Employee intrinsic motivation has a substantial positive influence on the intention to utilize Enterprise Bots (EB), according to the results of a structural equation model, but external variables have a lower impact. One of the most intriguing discoveries is that one's attitude about utilizing electronic books is the most important driver of real EB usage intention. It demonstrates that internal impacts (e.g., subjective standards or perceived behavioral control) are more relevant than external factors (e.g., external influences), allowing change managers to include these components in their efforts [37].

Vrushil Gajra et al. [38] have proposed that Robotic Process Automation (RPA) and Chatbot Technology may be used in a variety of manufacturing and organization procedures. Chatbots may be used successfully and efficiently in the retail and consumer products businesses, as well as in the education, manufacturing, and airline industries. Finance, government agencies, manufacturing, human resources, and education are just a few of the industries that might benefit from automation. Education is one of the industries where both chatbots and RPA may be used at the same time.

Santosh Maher et al. [39] described that, due to the widespread usage of messaging services and the advent of NLU, chatbots have lately gained popularity. Rule, Retrieval, and Generative-based are the three types of chatbots. A specified collection of phrases is grouped in a question-answer system in which each question is defined as a response in the form pair in a rule-based chatbot. AIML, an XML-based language for designing bots, was released in 2001.

Agarwal et al. [40] clarify that an open-domain dialog agent is supposed to handle several domains, whereas a task-oriented chatbot is domain-specific. When it comes to multi-turn conversations, it is critical that the chatbot can discuss in detail a topic, very much like a human. Biduski et al. [41] elucidate that Support Systems frequently feature virtual agents. Zhou et al. [42] consider both intelligent and emotional quotients in system design, casting human-machine social conversation as decision-making over Markov Decision Processes; XiaoIce is optimized for lengthy user participation as assessed by anticipated Discussion Each session. William Villegas-Ch has proposed an “Architecture for the Integration of a Chatbot with Artificial Intelligence in a Smart Campus for the Improvement of Learning” [43] the author elaborated on the use of technologies in institutions and he put forth that it motivates students to learn, and the student's enthusiasm increases, encouraging them to participate actively in their study. However, given the number of factors involved in this goal, creating an atmosphere



conducive to active learning will take a significant amount of time and work.

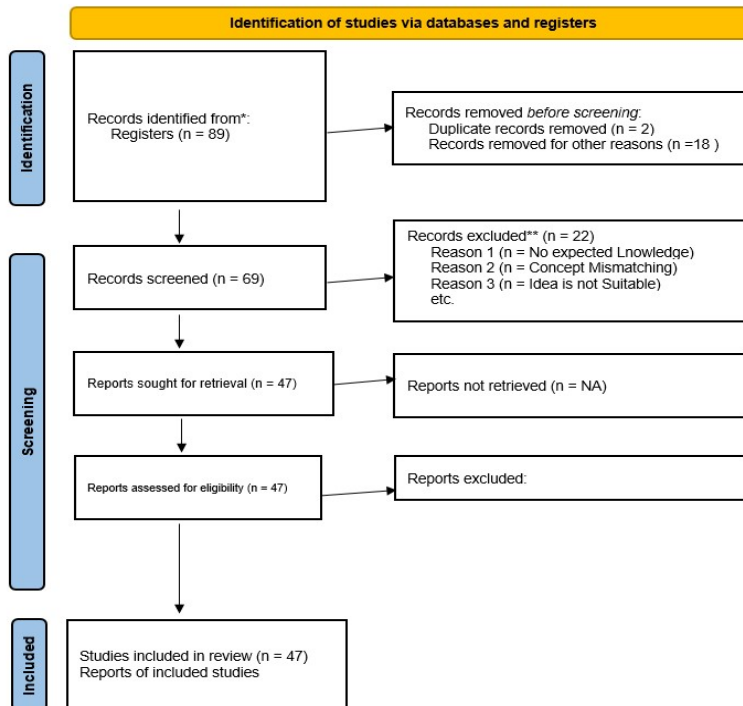
Yiping Song et al. have described [44] that Retrieval-based and generation-based systems are the two broad groups of conversation systems. Retrieval scans a huge conversation resource for a user-issued utterance such as a query and delivers a response that best matches the inquiry. New responses are synthesized using creative ways [45].

### 3.1 Comparison of Chatbot

Table 3.1 depicts the evolution of Chatbots from its beginning. It presents a comparison of conversational systems based on a set of key factors. From the comparison table, the year of publication, Techniques, Scheme, Drawback, and developers was listed from the research articles.

## 4 Methodology

PRISMA is an acronym for Preferred Reporting Items for Systematic Reviews and Meta-Analyses. It is a collection of evidence-based learned elements designed to assist narrates in reporting a wide range of systematic reviews and meta-analyses, which are primarily used to explore the benefits. PRISMA focuses on how writers can transparently present their research. The criteria for inclusion were as shown in figure 4.1 shows how information passes across the several phases of systematic reviews using the PRISMA flow diagram. The PRISMA flow diagram shows the number of records identified, including rejected ones, and the explanations for exclusions. The following processes of the systematic literature review were presented to survey the present study in the field of chatbots.





### 4.3 Included

In the next process of screening, 47 articles were included for the final study based on the various eligibility for inclusion in the systematic review. Based on the study, Table 3.1 presents the comparison of chatbot generations with their techniques, schemes, drawbacks, and used domains. Selected research articles are tabulated and the categorization is also there for future researchers to look into in detail for further study.

## 5 Discussion / Results

The study of the literature review was primarily based on a PRISMA investigation model. This study looks at the history of chatbots and their use in many fields. In the last several years, there has been substantial development in the invention and the usage of the chatbot, with numerous advantages in a variety of fields such as education, industry, health care, research labs, E-Marketing platforms, Group Chat Apps, and advertising.

### 5.1 Research Gaps

Presently Intelligent Conversational Systems have a verbal intelligence that is constrained. The most significant problem that chatbots are now facing is maintaining track of the situation of the conversation and understanding the human inputs and the respective responses [4]. Another key issue of a chatbot is to examine the various aspects of emotional difficulties that instructors experience and their origins. The most essential step in the development plans of chatbots is to strengthen language understanding and interpretation [2]. Chatbots are intelligent systems but they cannot think by themselves based on learning, which is a drawback of the present technology in building chatbots. For an effective intelligent conversational system, chatbot development needs to be planned and the platforms used to implement chatbot needs to be chosen properly [18].

Chatbots are largely employed in the education domain - teaching and learning process. As a dialogue system, AI systems might be used to deliver course learning content via a digital platform, capable of providing appropriate information to the users. Most systems focus on pattern-matching techniques but semantic approaches and computer reasoning systems need to be incorporated for the future development part of an intelligent system. Moreover, inclusive knowledge base designing needs to be improved in the development of general-purpose chatbots [46].

For Teaching-Learning Process, in LMS new ad-hoc can be added to help students and the institution with a personalized way of dealing with [47]. The majority of chatbot developments are done only for goal-oriented [16] and AI-oriented tasks. NLP technologies need to be used for building AI-Chatbots in the future.

## 6 Conclusion

Chatbots have a higher success rate than humans in using messaging apps to reach out to a large audience and generate substantial cost savings. This study presents an overview of the fundamental concepts of chatbots. The current state of technology is in a rapid transition phase,

intending to have equipment that can deliver solutions with minimum human intervention. This study examines several techniques to develop a chatbot, as well as the categorization and structure of these conversational bots. It also presents the design principles used to create many chatbots in chronological sequence.

The inability of today's modern Bots to recognize and produce actual discussions is the most serious issue they confront. At times, they would be unable to interpret a phrase, leading to inconsistency in communication and uncomfortable interaction with their listener. The most crucial phase in Chatbot development is to increase language understanding and output.

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**Table 1.** Table captions should be placed above the tables.

Year	Chatbot	Technique	Scheme	Drawback	Authors	Application Domain
1950	Turing Test [10]	Natural Language	An interrogator had to determine which player was a human	It cannot measure intelligence that is beyond the ability of humans	Alan Turing	-
1966	ELIZA [5]	Rule-Based Approach Pattern Matching	Response selection scheme (rephrasing the patient’s statement)	Knowledge Limited Particular Domain of Topic Cannot Keep long Conversations or discover the same	Artificial Intelligence Laboratory in MIT LAB	Hospital
1972	PARRY [11]	Rule-Based Approach	Interviewing with his therapist	Low Speed of Responding Cannot Learn from the Conversation	Kenneth Mark Colby, Stanford's Psychiatry Department	Hospital
1983	Racter [15]	Knowledge-Based	Emotional Responses	Low capabilities concerning language understanding	William Chamberlain and Thomas Etter, Inrac Corporation	Education
1988	Jabberwacky (written)	Contextual Pattern Matching	Mimic human interaction	Still unable to respond at a rapid rate.	Rollo Carpenter	Entertainment, Marketing

	in CleverS cript) [9]		and carry out conversation among users			, Robots & Robotics, Digital Pets, Gadgets & Games
197 1	SHRD LU [16] [17]	Clarifications, grammatical detection, Semantic Analysis, Parsing	Understood basic English statements and executed commands in English dialogues	Could not understand a sentence through the use of context and physical knowledge	MIT, Terry Winograd	Education (English Dialogue System)
199 2	Dr. Sabaito o (speech synthes is) [15]	Text-to- Speech	First bot to utilize text- to-speech functioning	Knowledge Limited	Creative Labs for MS-Dos	Education
199 5	ALICE (Alicebot)	Heuristic pattern matching XML knowledge bases	Domain- Specific	Alice lacked clever traits. Couldn't come up with human-like responses, expressions, or attitudes.	Richard Wallace	Entertain ment
200 1	Smarter Child (comm ercial instant messagi ng bot) [18]	Processing queries asked in natural language	Throughout the world's instant chat and SMS networks	Knowledge Limited	ActiveBu ddy	Education
201 0	Apple Siri (intellig ent voice assistan t) [23]	Natural Language UI Natural Language Processing	Responds to user requests using various internet services	It requires an internet connection. you can't use it when you are offline It is	Apple for iOS	Social Media (Post statuses or tweets to Facebo ok or Twit



				multilingual, but instructions are only in English. doesn't understand all spelling variations It also has difficulties in hearing		ter reminders, driving directions and playing music)
2011	Watson [14]	Natural Language Knowledge Base	AI-powered virtual agent designed to provide customers with fast, consistent, and accurate answers across any messaging platform, application, device, or channel	It supports only English Slow integration.	IBM	Weather forecast (Building codes, Weather forecasting, Fashion, Advertising, Healthcare,...etc)
2012	Google Now/Google Assistant [45] [24]	Natural Language	predict actions by passing requests to a set of web services two-way dialogue with the user	Smart home capability is limited	Google Inch	Voice Assistant
2005	Mitsuku (Kukui or Pandorobot) [4]	AIML technology	Intelligent	Ability to reason with specific objects	Steve Worswick	

2014	Cortana [27]	Goal-Based	Perform tasks like reminders Available in different languages	It can launch software that distributes malware.	Microsoft for windows-based devices	Use information from the Bing web search to make reminders, identify natural speech, and answer queries.
2014	Alexa [1]	Knowledge-based & virtual assistant technology	Which is built-in home automation (IoT)	Sometimes, users' queries can be misunderstanding occur Cannot understand particular language (oral speech)	Amazon	Google Devices
2016	Bots for Messengers [14]	Rule-Based	Understand questions, provide answers, and execute tasks.	Have limited responses and are not often able to answer multi-part questions or questions that require decisions	Facebook	Social Media
2016	TAY [15]	Experimental artificial intelligence	Twitter to mimic the speech and habits of a teenage girl	Had to be shut down just 16 hours after launch.	Microsoft	Social Media