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An Evaluation of Chatbots On The Basis Of Human Cognitive Factors

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ABSTRACT
Chatbots are marvelous innovation of Artificial Intelligence designed to mimic and simulate human conversation through the best use of Natural language processing and Artificial Intelligence. Their purpose lies at formulating and generating a human like response for the query asked. Advances in machine learning and AI has led researchers to develop chatbots to assist humans in varying tasks like helping customers in buying and selling products as well as to be used in routine tasks in the field of health, education and commerce. Design and developments of the conversational agents can be varied in many ways to be falling them into different categories. Now a days AI is claiming to develop humanoid chatbots who are well versed in controlling their dialogue. Hence the main aim of the study is to explore the chatbots from 1960 to 2020 and highlighting the design issues with help of understanding human cognitive factors. In this regard past literature has been studied closely and after that designs issues are carefully highlighted. There are many challenges and limitations in their application which restrain them from being more humanoid. So the study comes up with highlighting main challenges and deign issues in the state of the art chatbots and on the basis of those challenges few focus area are highlighted for future research investigation.

Keywords: Chatbots; Artificial Intelligence; Conversational agents; Natural Language processing; Design; Cognitive

1. INTRODUCTION

A conversational agent or chatbot derived from the word chatterbot is a software program that has ability to simulate human conversation through text or voice communication. Conversational agents are rightly said to be intelligent agent because they are developed to make our lives easier by integrating Artificial Intelligence and NLP [1, 2]. They are widely being used in various industries like healthcare, education and retail [3]. Conversation between human and a chatbot can take place through text, voice and graphical widgets [4].The Idea of chatbot was emerged in late 1950 when Alan Turing asked a question, “whether machine can think or communicate the way human can do ?”. From that time AI is striving at its best to inculcate all the human traits regarding intelligence and it is conspicuous from the literature that human -machine interaction is one of those human traits [5].Components of a chatbot comprise of Natural language understanding, Natural language generation and a dialogue manager [6]. Language Understanding is responsible for parsing the text to make it in machine understandable format and then dialogue manager has capabilities of generating the required responses [7]. Natural Language understanding and context understanding has become the more considerable components of the conversational Agents in order to make them more human like. Context understanding modules also has much more importance as it is part of parsing the text [8]. Depending upon the usage the chatbots are divided into different categories, When classified on the basis of knowledge and domain, they fall in two prominent categories; general category leading chatbots to be open ended and task oriented leading them to be closed ended like flight booking system [1, 9].

After the recent advances in technologies specifically in AI, chatbots have been evolved to adjoinncognitive skills. Few efforts have been made to integrate emotional intelligence in these conversational agents [10]. Researchers proved Efforts have been put to make chatbots eligible for generating dialogues on the basis of their own understanding. These efforts are visible from Eliza to Sophia. But still there is a need to make more efforts for adding more human like traits [4]. Chatbots built for companionship can be user friendly and can even talk about human’s interest [9]. But chatbots are not only built for this, they are mostly being built to take place humans where interactions with other human is important [11]. So to replace humans, they must have the capabilities like humans. Even after passing Turing test still development of an intelligent chatbot is a challenging task for AI. Whereas state-of-the-art chatbots seem like pre-programmed and accompanied with the limited capabilities of comprehending the queries as the response are

already saved and stored [12]. In this paper past and present literature has been explored and studied closely to have a clear insight about the architecture of the state of the art chatbots from the perspective of time. After an extensive literature review it was deduced Chatbots are used mostly in the websites where customer care is given importance. Few fields where most of the research is focused include, Health, Education, Customer service, Business and entertainment. But no evidence was found them to be human like on the basis of controlling and regulating their own response after learning from their past experience. In this paper an effort has been made to review the state of the art chatbots and their architectures from the perspective of technologies added and the functions performed by them and highlighting the cognitive design issues of the state of the art chatbots. Humanoid chatbots will benefit more in companionship, mental health service and in hospitals even they can benefit in customer services too. Section 2 presents the history of chatbots by mentioning their time periods. Section 3 presents a brief explanation about the general architecture of chatbots and role of NLP in the design of chatbots. In Section 4 an overview of all the stated chatbots presented from the perspective of their categories Section 5 is comprised of the design issues of the state of the art chatbots and Section 6 ends the paper with a conclusion of the paper.

2. HISTORY OF CHATBOTS

2.1. Chatbots from 1966-2000

When intelligent agents are used in chat purpose and well versed in responding user's conversations they are called as chatbots [4]. But they are serving more than a messaging app and their use is becoming ubiquitous. State-of-the-art literature about chatbots has been explored and studied closely to review the design and techniques used in building chatbots. In spite of the limitations in their use, developments are obvious from ELIZA to Mitsuku. As the interest of the study lies to take a deep dive into developments of the chatbots so in this regard an attempt has been made to represent these architectures according to their time frame. First ever chat bot ELIZA [13] was developed in 1966 for time sharing system of MAC and served as psychotherapist which generated responses through matching keywords present in the text and by decomposing the sentence, keywords of the system are associated with precedence or RANKS and transformation rules. Finding the appropriate keywords and their transformations was among Deficiencies of ELIZA as highlighted by researchers. PARRY[14] developed in 1972 was imitation of paranoid schizophrenic patient. PARRY is accompanied with the emotions like fear and angry. PARRY had improvements as compared to ELIZA as it represented a personality and was used to check the authenticity of the questions asked by ELIZA. Hence in the first decades after the development of first chatbot, most work is confined to the template-based approach of the chatbots to introduce closed ended chatbots.

ALICE [15, 16] developed in 1995 is an open source chatbot developed through AIML and is implemented through pattern matching algorithms as it has predefined set of responses. Architecture of the ALICE is comprised of semantic mapper, a context mediator, a topic navigator and a response generator. Rules for matching an input and converting it into an output are stored in the form of categories. ALICE was sometimes unable to provide accurate responses. CLEVER Bot [4] was developed in 1997 by AI scientist Rollo Carpenter in 1997 which is not hard coded instead has the expertise of learning from human input from the conversation process. It is a mobile app available both for iOS and android users. Cleverbot learns from the previous conversations of humans. Hence after 60's restructuring was seen in the architecture of chatbots and they proved to be good example of weak AI.

2.2. Chatbots from 2000-2018

CLIVE [17] developed in 2008 is an open ended chatbot with the capabilities of language learning chatbot and can capture the user's attention by speaking on any topic/area of their interest. CLIVE was developed through my Cyber Twin platform and uses an instant messing app for that purpose. CLIVE is a retrieval system who is proficient in understanding and translating Greek and English language. Mitsuku [6] developed in 2012 is winning the Leobner Prize for four times in a row for the reason of being Huma like conversational Agent as it has capabilities of reasoning. Mitsuku is a rule based conversational agent. ALEXA [18] first introduced in 2013 was developed by Amazon as a digital personal assistant which is operated on Amazon echo and it takes commands through voice or text and fulfils the user's request by performing the tasks such as informing about weather, connecting to radio and television to play music, and etc. ALEXA or Wake ALEXA words spoken by user activate it to perform desired tasks. ALEXA picks up speech patterns and recognizes them through Machine learning and NLU (Natural Language Understanding) and

hence it is an Information retrieval system. Siri by Apple is also an intelligent personal assistance which understands the voice commands of the users and provides services related with built in devices of the apple device. Like ALEXA Siri is also an information retrieval system. Octupus [19] developed in 2015 can accept the input in both voice and text form and is an multi-agent open ended conversational agent. Composition of octopus comprises of 8 sub multi agent systems Natural Language Processing system, communication system, learning system and action system for handling its high-level intelligent capabilities.

2.3. Chatbots from 2016-to-date

After the boom in AI after 2016, chatbots were also evolved to have more intelligent capabilities in terms of generating more human like dialogues. SARA [20] developed in 2016 is a personal assistant whose purpose is to maintain a social interaction by focusing the user's gestures. After speech recognition and intent analysis, speech features are extracted. And then to main social interaction face features are taken as input for Rapport Estimator to understand behaviors. On the basis of all these sentences and behaviors are generated and required response is retrieved from database. MILA Bot 2017 [21] based on deep learning enforcement methods was developed for the competition held by Amazon for social bots having capability to converse thorough AMAZON echo device. MILA Bot can generate dialogue through ensemble methods including generative methods, retrieval methods and template-based methods. MILA bot is built using statistical machine learning techniques for reinforcement learning on the basis of real-world interactions and for response generation Bot utilizes 22 response models. Evaluation of MILA Bot through A/B testing gave the better results as compared to other contestants of the competition. DINA [22] developed in 2018 chatbot is served as university candidate service. DINA is accompanied with Q/A for admission services of the university aimed at serving only university students. Users are provided with answers through pattern extracted from the knowledge base of DINA. FIT-Bot [23] introduced in 2018 is an intelligent assistant which works as informational retrieval system and provides administrative support at a university. GegnoBot [24] developed in 2019 is a grammar application based chatbot. Main purpose of GegnoBot is to explain the Japanese grammar in three languages; Japanese, English and Indonesian language. GegnoBot is developed in integration with LINE BOT DESIGNER and has the capability of understanding the questions and providing the most suitable response from the liked database of grammars. Intents are used through Dialog flow.

Meena [25] developed in 2020 was presented as an open-ended dialogue based chatbot serving the basic purpose of authors to introducing sensibility and specificity as two evaluation matrices for open ended chatbots. MEENA is trained on data extracted from social media conversations having 40 billion words. BLEU was used as evaluation matrices. Charlie [26] introduced in 2021 was developed for the sake of companionship for elderly people and to solve their old age-related problems so that they might not be victimized by psychiatric problems. Charlie is based on rule based and gives the most fitting response to the user after understanding the context of the conversation. Asasara [27] introduced in 2022 was developed to be used for educational purpose and has ability to perform the teacher/mentor and role play of a snake Goddess. The Authors aimed to provide the usefulness of advance AI in teaching environment by implementing the chatbot as a mentor. The close and open ended both types of questions are supported in the system. Online data sources were also used. HELENA[28] developed in 2022 is a digital assistant developed to main user 'health information in a single profile which remains lifelong. Helena is a closed ended conversational agent which is employed through a text-based interface. Sentence have templates. List of items are provided through retrieval systems. So, it can be deduced that use and development of chatbots was increased after 2005 and the focus of AI was to develop humanoid robots who can replace human and reply in a humanoid manner. After studying the literature, it can be inferred that with developments of AI and NLP chatbots have been reshaped. They are shifted from simple template based or rule-based techniques to generating response on their own using neural networks. Focus on the technical aspect of chatbots has evolved over the time helping in developing improvised version of chatbots Their dialogue techniques are better as compared to early chatbots but still they lack human traits which are responsible for giving them capabilities of reasoning about their responses, controlling their dialogues and changing their responses according to the confronted environment.

All these eras are showing a great development in the technological aspect of chatbots but still generalization remains the major concern [29]. Few chatbots are claiming to embed ontology in them as the data around us is becoming enormous with every passing day and it becomes a challenging task to add relationships and associations among the

entities. Same case is with the concept of metacognition for making chatbots aware of themselves and generating dialogues on their own. These are few concepts which are still under consideration and under construction to make chatbots for fully humanoid. Table 1 presents the chatbots along with their features.

Table 1. Chatbots along with their features

Name	**Purpose(Domain specific/general)**	**Dialogue management**	**Type on the basis of response**	**Data Source**
CLIVE [17]	Open(translator of the native languages)	Natural Language Learning, Translation Engine and chat controller	Rule Based	Previous conversations and already stored knowledge
Erika [30]	Closed	Dialog flow, ROS.(client/Server architecture)	Rule Based	Web Application
GegnoBot [24]	Japanese Language Proficiency Test based on three language .(Japanese, English and Indonesian)	Dialog flow	Information Retrieval	SQL, Database/social Media
Asasara [27]	Closed(Mentor to represent a character of snake Goddess)	Dialogue manager responsible for all the question/answer sessions	Information Retrieval	Knowledge Base/Web
Alexa [18]	Open Domain. Personal Assistant.	Through App interface. Speech recognition .Natural Language understanding.	Information Retrieval	
CLEVERBOT [4]	Chatterbot	Searches for the required response through keywords	Information Retrieval/Generative	Generative(learns from user's input)
MS Cortona [31]	Close ended	Searches for the required response through keywords	Retrieval	
Octupus [19]	Open ended	Multi Agent system		
SIVA [10]	Open	Adaptive Approach for generating response. Context sensitive response is generated	Generative Dialogue	Memory(previous responses were saved) +database
DINA [22]	Students consultant	Keyword searching and providing responses	Retrieval	Know ledged Based. Already saved knowledge
SARA [20]	Open ended	Dialog manager consists of Task reasoner, Task History, Social reasoner and Social History	Information retrieval	Database connected

Eliza [13]	Open ended	Keyword base search and provides responses accordingly	Rule based	Already stored knowledge about the queries
PERRY [14]	Closed ended	Keyword base search	Retrieval Based	-do-
A.L.I.C.E [15]	Open ended	A stimulus-response based chatbots	Rule based	
Mitsuku [6]	Open ended	Dialog rules are written in AIML. At the end human manager manages the new learned data	.Rule Based/Generative response	Learns from the responses

3. DESIGN OF A CHATBOT

Chatbots or conversational agents can be named as conversational software or messaging apps which normally have an interface, database on the backend and a strong retrieval system[4].Every conversational agent comes with certain features. After studying existing chatbots, to recapitulate the whole discussion about architectures about all chatbots regardless of their domain, only core components are discussed here. In research articles [8, 32, 33] the core components are described as NLU, dialogue manager and NLG and further sub components of these three core components. Conversation with the chatbots takes place through text or voice which is also converted into text through speech to text [34]. The input is then parsed by Natural language understanding unit to identify and classify the intents of the conversations from the identified contexts [1, 7].which is then interpreted in a best possible manner. And then dialogue manager decides about the next step and response generation module is activated for generating the best response according to the input.

3.1. Role of NLP in the Architecture of Chatbots

Although Recent bloom in Artificial Intelligence and Natural Language Processing techniques have made implementation of chatbots more comfortable and supple on the basis of being more humanoid so to induce the conversational capability in chatbots it is necessary to fully understand the use of NLP in their architecture [2]. AI and NLP plays a vital role in context understanding and dialogue generation mode and input is also taken from natural language. NLP part of the chatbots comprises of NLU and NLG[1].NLU starts with the intent understanding as it is important to understand what user is trying to ask for and it helps in interpreting the emotions of the user [35]. A clear understanding of the conversation makes chatbots more socially interactive. Hence NLP is becoming one of the biggest challenges in constructing chatbots as it has various fields including understanding the intent and meaning of the text [3].

3.2. Dialogue Manager

Middleware part is served through a dialogue manager of the chatbot architecture. Dialogue manager is responsible for all the conversation and providing the appropriate response to the user. This module helps in predicting the next step in response generation process. Third part is fetching the appropriate responses according to the queries. Here in this module, Information Retrieval and Knowledge Base: In this component search for the most suitable responses stored in the knowledge base or it can be fetched from the web pages stored or can be generated through the neural networks. Hence Dialogue manages has three sub components, Information retrieval, Rule based and response generation. At the end fetched information is sent back to the dialogue manager. General design of a chatbot is represented in Figure 1.

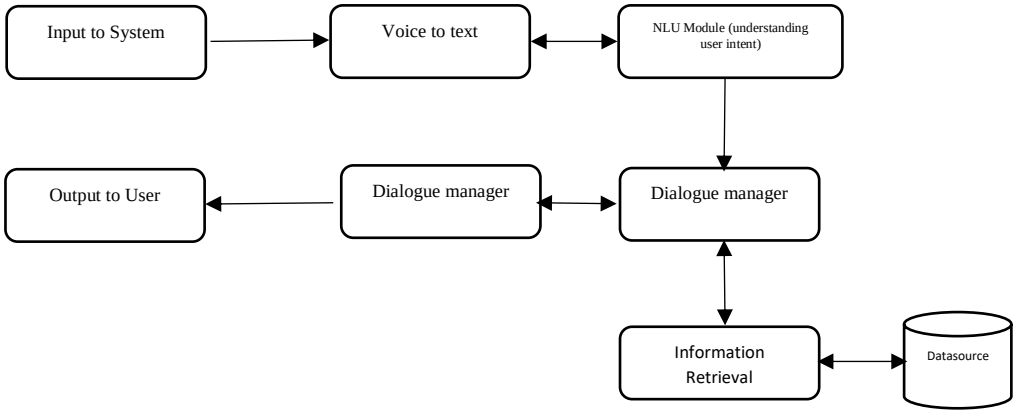


Figure 1. General design of chatbot

4. CATEGORIZATION OF CHATBOTS

The first emerged chatbot ELIZA was a text based and worked on matching patterns but with the advent of technologies and proliferation of the chatbots led to add enriching the rules of NLU and NLG in their formation. Further to make the chatbots more human like few other concepts of ontologies, memories and reasoning to identify intents were also integrated [36-38]. Therefore, the chatbots do not fall under a single category rather they have various parameters which define different categories of them [33] described three parameters of chatbots 1) keyword recognition based 2) rule based and 3) context based[1] elaborated classification of chatbots in a more detailed manner and define the following parameters for their categorization 1) knowledge domain 2) service provided 3) goal oriented and 4) response generation methods. Each category has further sub-categories [11] classified chatbots on the basis of deep learning algorithms. To have deep insight into the categories and classification of the chatbots. Three parameters have been identified to categorize the chatbots. These including Domain specific, Modality and Response generation module.

4.1. Domain Specific

As stated earlier that conversational agents are mainly used in fields like Education, Customer service, Business and entertainment[3]. If division is drawn on the basis of Domain being used, they fall in two prominent features namely open ended and task oriented like flight booking system [9, 27]. The capability of chatbots to converse on any topic using in natural language makes them open domain while closed domain or task oriented chatbots can only respond to keywords or intents to carry out specific tasks [25].

4.1.1. Open Ended Conversational Agents

Developing open ended chatbots remains the big interest of AI and NLP for the reason of being challenging area and they mostly use neural network-based approaches [9]. Few states of the art open ended chatbots include Meena [25], SIVA [10], CleverBot [4], CLIVE [17], OCTUPUS, Mitsuku, A.L.I.C.E, MILABot [21] etc. Adding human like feature in Open ended conversational agents is becoming the distinctive hallmark of Artificial Intelligence.

4.1.2. Closed Ended/Task Based Chatbots

Conversational agents built for carrying specific tasks are called as task based, task oriented or closed ended chatbots. From the past literature the fact can be deduced that they're not considered as good approach but meanwhile they are robust while carrying their specific tasks. Examples include Asasara [27], Helena [28], Dina [22], PARRY [14] and Intelligent Voice Assistants like Alexa, Siri Eliza etc.

4.2. Modality

Chat based agents talk with users in a multiplicity of ways, such as personified chatty beings, text-based user interfaces, and voice user interface [34]. So depending upon the input type they can be further classified into two

categories, text based and voice based. Various conversational agents are endowed with both input capabilities text and voice. Conversational agents are being deployed more in customer care, so they must be endowed with social interaction capability by keeping trust of the users in special consideration [39]. Gegno, Asasara, Erika, chat GPT, DINA, ELIZA, PARRY, ALICE, Mitsuku are some examples of the text based chatbots and Voice based instances include Alexa, Siri, Cortona, Octopus etc.

4.3. Response Module

Conversational Agents may be task oriented or they can be open domain [40]. To make the HCI stronger a lot of efforts have been out to make the chatbots socially and emotionally aware of the user's feelings and emotions. So that they may be well versed in engaging in the conversations with humans and responding like humans. Concept of human aided chatbots was also introduced in this regard where chatbots utilizes the human computational skills. From the literature it has been observed that chatbots can be varied in design and methods. If we specifically discuss about methods than these methods include multiple strategy chatbots (combination of more than method), which are able to generate response after carefully understanding the intent of the users, they can be subdivided into three major categories;

4.3.1. Rule Based/Template Based/Pattern matching

Researcher endeavored in developing human like conversational agents which resulted in Pioneer like Eliza and ALICE developed through Rule Based Approach. Rule based approach work on predefined set of rules or templates already stored manually in chatbot memory [9]. Rule Based approach is implemented through AIML. This type of approach is used mainly for simple tasks and does not always lead to correct responses. Rule Based work on understanding the lexical form and meaning of the text and provide the already recorded response based on rules. Bot builder and AIML are mainly used for building those rules. Templates and pattern matching techniques are used to cleverly generate responses. Pattern matching through machine learning helps in extracting information from the knowledge base [22]. They are preferred for simple tasks and mostly used for replying the simple queries in business or scheduling a meeting according to the available time slots. Moreover, manually entering the templates and rules make it a tedious job for the programmer s. As already stated first ever chatbots was built through pattern matching was ELIZA (1966). Charlie [26] has been employed through a rule-based approach. PARRY [14] also uses pattern-based approach to simulate a schizophrenic patient.

4.3.2. Retrieval Base

Retrieval Based and generative response based chatbots both fall under the category of Neural Network based conversational agents [9]. Retrieval Based are expected to generate more accurate response but they have limitations over producing responses as they have a limited corpus [41].They generate responses grounded with computation of conditional probability and most fitting response[16].Techniques used in retrieval based chatbots can be TF-IDF, DNN or RNN [41]. GegnoBot [24], FIT-Bot [23].

4.3.3. Generative Response

They are Artificial Intelligence chatbots based on machine which enables to learn them learning from existing human conversation.ML algorithms allow them to be more flexible[recent literature]. Chatbots falling in this category don't generate pre-programmed answers rather they take input word by word and then generate the responses [42].They are rightly called as the smarter conversational agents as they have tendency to generate more natural response. Because of their ability to use a large corpus they are well suited for open domain dialogues [43] presented and proposed a neural response generator machine through encoder-decoder framework with the realization of Recurrent Neural Network (RNN). Data of about 4.4 million conversations is collected from weibo and is used to train NRM. As NRM has capabilities of generating appropriate responses octopus.

It has been evident from the literature that the chatbots can be categorized on the basis of different parameters; Domain (Open and closed domain), Technologies used, Physical appearance using an avatar or messaging apps [44]. Embodied agents may come with the feature of multi-modality to cater the user's interest and develop an ease of interaction through appropriate gestures [45]. While designing chatbots, Rule based learning is added or machine learning algorithms are used [5].

It is obvious from the data collected about chatbots that Rule Based responses are best to be used for closed ended chatbots. But when Input is larger than it becomes difficult for developers to define rules as it relies on the manual efforts. In the interim of large corpus and for open ended dialogues generative methods are preferred, sometimes used along with the retrieval methods. Possibility of generating wrong answers is higher in generative models but still they are preferred for providing near human replies. Moreover the user's speech serves as the basis for deciding the responses and the state of the responder including knowledge state and emotions; is ignored. The study can be further expanded by concentrating on the techniques used for generating responses i.e seq to seq and neural networks.

5. CONCERNS ARISING FOR CHATBOTS

5.1. Reasons to Use Chatbots

Chatbots can be used in variety of ways including for accomplishing a specific tasks or for companionships. Every researcher answers this question provided by the type of research they conducted on chatbots. Few defined them as the agents for answering certain queries [2] while few defined them as a best alternate of the humans for companionship [6]. To sum up the whole discussion about the usage of the topic, the conclusion is drawn on the basis of study from existing literature is that chatbots tend to replace humans. When they are developed as task oriented then it becomes their responsibility to satisfy the customer asking for some specific response and when they are built for companionship then they must have the capability to respond in the same way as humans do. So the study aims at exploring the answer that, whether state of the art chatbots are proficient enough for conversing like humans.

5.2. Design Issues and Characterizing Humanoid Traits in Chatbots

The study further explores the architecture of the chatbots and the basis for the categorization of the chatbots to dig in the presence of human cognitive factors in chatbot. Capabilities of machines to converse like human with humans in human natural language are the biggest achievement for the Artificial Intelligence leading to develop open domain chatbots but in spite of all the efforts these conversational agents still have limitations of generating vague answers when they don't have the exact answers [25]. Even the contestants of Turing test reply in a vague manner just to avoid being detected as machines [46]. Development of intelligent chatbots with the human-like conversation capabilities leads to the hypothesis that conversation is a cognitive process. Hence a chatbots claiming to be humanoid must have cognitive skills i.e. perception, learning, experience, emotions, decision making. Building a social chatbot with emotional skills has been a challenge for the researchers [47]. Agents now a days have ability to do variety of tasks which include labor work and even some more reasonable tasks like mimicking the humans but they are not only built for these purposes only [48]. They are being built for more complex tasks which range from assisting human to perform a specific task like human beings. Many features are added in them to make them resemble with a human being. These features include conversational style [49], interactions with human developing emotional relationship with humans. Indeed, research is being proceeded to build machine with human traits specifically to simulate human Brain. And the fact can't be denied that human brain is always aware of its environment [44].

The first highlighted issues is the capability of socially engaging in interactions by developing emotional relations as human communication is accompanied with emotions and feelings which usually a chatbots does not have and emotions play an important part of human cognition during conversation as they have great impact on the user's mood and feelings towards a chatbots. To accomplish this task an important obstacle for computers is that they must be able to not only understand the meanings of words, but also comprehend the endless variability of expression in how those words are used in a language to communicate meaning. Intelligent Agents are embedded with limited depth of information regarding a topic which leads to a less contextual awareness. Conversation between humans is always topic oriented and revolves around accomplishing a specific goal. And conversations always take place on the basis of previous knowledge stored in our mind. More the knowledge has depth, more the computers will have command have on answering regarding a specific topic. Hence will have capability of checking and regulating their own responses. Third most important factor missing in chatbots is Adaptive learning. Somehow chatbots have ability to learn from their interactions but still lack with the ability of learning from a specific conversation. Lack of appropriate learning leads to the compromised capabilities of Reasoning.

The aims to explore the fact that the chatbots claiming to be humanoid are having humanoid factors are not. For the said purpose first humanoid factors involved in a conversational process are studied. As conversation communication being the part of the cognitive process, cognitive factors i.e. perception, memory structures, learning, reasoning and decision making are sought after in chatbot.

6. CONCLUSIONS

Concern of the AI lies in developing human like chatbots. Humans have the capabilities of understanding and relating the objects based on their properties and reasoning capabilities and controlling their dialogue. So, after studying and exploring all stated chatbots, the deduced fact is that all papers are presenting the technological aspect of the chatbots and they are doing well in their specified domains. But work has to be done to develop chatbots who are well versed in open domains and have capability of engaging humans. Hence the chatbots need to have enormous sources of knowledge and learning from their past experiences which will be added to their knowledge and hence leading them to be able to control their own dialogues on the basis of their knowledge and learning. The capability to reason about decisions taken to generate responses and controlling their responses is known as metacognition. It is obvious from the state of the art literature there is no strong evidence about the presence of cognitive and metacognitive abilities in chatbot.

REFERENCES

[1] Adamopoulou, E. and L. Moussiades. *An overview of chatbot technology*. in *IFIP international conference on artificial intelligence applications and innovations*. 2020. Springer.
[2] Lalwani, T., et al., *Implementation of a Chatbot System using AI and NLP*. International Journal of Innovative Research in Computer Science & Technology (IJIRCST) Volume-6, Issue-3, 2018.
[3] Abu Ali, D. and N. Habash. *Botta: An arabic dialect chatbot*. in *Proceedings of COLING*. 2016.
[4] Ahmad, N.A., et al., *Review of chatbots design techniques.* International Journal of Computer Applications, 2018. 181(8): p. 7-10.
[5] Adamopoulou, E. and L. Moussiades, *Chatbots: History, technology, and applications.* Machine Learning with Applications, 2020. 2: p. 100006.
[6] Croes, E.A. and M.L. Antheunis, *Can we be friends with Mitsuku? A longitudinal study on the process of relationship formation between humans and a social chatbot.* Journal of Social and Personal Relationships, 2021. 38(1): p. 279-300.
[7] Kucherbaev, P., A. Bozzon, and G.-J. Houben, *Human-aided bots.* IEEE Internet Computing, 2018. 22(6): p. 36-43.
[8] Mohammed, M. and M.M. Aref, *Chatbot system architecture.* arXiv preprint arXiv:2201.06348, 2022.
[9] Agarwal, R. and M. Wadhwa, *Review of state-of-the-art design techniques for chatbots.* SN Computer Science, 2020. 1(5): p. 246.
[10] Aneja, D., et al. *Understanding conversational and expressive style in a multimodal embodied conversational agent*. in *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 2021.
[11] Caldarini, G., S. Jaf, and K. McGarry, *A literature survey of recent advances in chatbots.* Information, 2022. 13(1): p. 41.
[12] Singh, S. and H. Beniwal, *A survey on near-human conversational agents.* Journal of King Saud University-Computer and Information Sciences, 2022. 34(10): p. 8852-8866.
[13] Grishman, R., *Computational linguistics: an introduction*. 1986: Cambridge University Press.
[14] Zemčík, M.T., *A brief history of chatbots.* DEStech Transactions on Computer Science and Engineering, 2019. 10.
[15] AbuShawar, B. and E. Atwell, *ALICE chatbot: Trials and outputs.* Computación y Sistemas, 2015. 19(4): p. 625-632.
[16] Ghose, S. and J.J. Barua. *Toward the implementation of a topic specific dialogue based natural language chatbot as an undergraduate advisor*. in *2013 international conference on informatics, electronics and vision (ICIEV)*. 2013. IEEE.
[17] Zakos, J. and L. Capper. *CLIVE–an artificially intelligent chat robot for conversational language practice*. in *Artificial Intelligence: Theories, Models and Applications: 5th Hellenic Conference on AI, SETN 2008, Syros, Greece, October 2-4, 2008. Proceedings 5*. 2008. Springer.

[18] Lopatovska, I., et al., *Talk to me: Exploring user interactions with the Amazon Alexa*. Journal of Librarianship and Information Science, 2019. 51(4): p. 984-997.
[19] Hettige, B. and A. Karunananda, *Octopus: a multi agent chatbot*. 2015.
[20] Matsuyama, Y., et al. *Socially-aware animated intelligent personal assistant agent*. in *Proceedings of the 17th annual meeting of the special interest group on discourse and dialogue*. 2016.
[21] Serban, I.V., et al., *A deep reinforcement learning chatbot.* arXiv preprint arXiv:1709.02349, 2017.
[22] Santoso, H.A., et al. *Dinus Intelligent Assistance (DINA) chatbot for university admission services*. in *2018 International Seminar on Application for Technology of Information and Communication*. 2018. IEEE.
[23] Hien, H.T., et al. *Intelligent assistants in higher-education environments: the FIT-EBot, a chatbot for administrative and learning support*. in *Proceedings of the 9th International Symposium on Information and Communication Technology*. 2018.
[24] Haristiani, N., et al., *Gengobot: A chatbot-based grammar application on mobile instant messaging as language learning medium.* Journal of Engineering Science and Technology, 2019. 14(6): p. 3158-3173.
[25] Adiwardana, D., et al., *Towards a human-like open-domain chatbot.* arXiv preprint arXiv:2001.09977, 2020.
[26] Valtolina, S. and L. Hu. *Charlie: A chatbot to improve the elderly quality of life and to make them more active to fight their sense of loneliness*. in *CHItaly 2021: 14th Biannual Conference of the Italian SIGCHI Chapter*. 2021.
[27] Mageira, K., et al., *Educational AI chatbots for content and language integrated learning.* Applied Sciences, 2022. 12(7): p. 3239.
[28] Polignano, M., et al., *HELENA: An intelligent digital assistant based on a Lifelong Health User Model.* Information Processing & Management, 2023. 60(1): p. 103124.
[29] Taecharungroj, V., *"What Can ChatGPT Do?" Analyzing Early Reactions to the Innovative AI Chatbot on Twitter.* Big Data and Cognitive Computing, 2023. 7(1): p. 35.
[30] Arequipa, P. *An Architecture for Social-Aware Navigation Based on a Chatbot Interaction*. in *Workshops at 18th International Conference on Intelligent Environments (IE2022)*. 2022. IOS Press.
[31] López, G., L. Quesada, and L.A. Guerrero. *Alexa vs. Siri vs. Cortana vs. Google Assistant: a comparison of speech-based natural user interfaces*. in *Advances in Human Factors and Systems Interaction: Proceedings of the AHFE 2017 International Conference on Human Factors and Systems Interaction, July 17− 21, 2017, The Westin Bonaventure Hotel, Los Angeles, California, USA 8*. 2018. Springer.
[32] Feine, J., S. Morana, and A. Maedche, *A chatbot response generation system*, in *Proceedings of Mensch und Computer 2020*. 2020. p. 333-341.
[33] Gupta, A., D. Hathwar, and A. Vijayakumar, *Introduction to AI chatbots.* International Journal of Engineering Research and Technology, 2020. 9(7): p. 255-258.
[34] Harms, J.-G., et al., *Approaches for dialog management in conversational agents.* IEEE Internet Computing, 2018. 23(2): p. 13-22.
[35] Maher, S., S. Kayte, and S. Nimbhore, *Chatbots & its techniques using AI: an review.* International Journal for Research in Applied Science and Engineering Technology, 2020. 8(12): p. 503-508.
[36] Wen, T.-H., et al., *Semantically conditioned lstm-based natural language generation for spoken dialogue systems.* arXiv preprint arXiv:1508.01745, 2015.
[37] Bohus, D. and A. Rudnicky, *Ravenclaw: Dialog management using hierarchical task decomposition and an expectation agenda.* 2003.
[38] Jain, M., et al. *Evaluating and informing the design of chatbots*. in *Proceedings of the 2018 designing interactive systems conference*. 2018.
[39] Jenneboer, L., C. Herrando, and E. Constantinides, *The impact of chatbots on customer loyalty: A systematic literature review.* Journal of theoretical and applied electronic commerce research, 2022. 17(1): p. 212-229.
[40] Agarwal, S., et al., *A knowledge-grounded multimodal search-based conversational agent.* arXiv preprint arXiv:1810.11954, 2018.
[41] Peng, Z. and X. Ma, *A survey on construction and enhancement methods in service chatbots design.* CCF Transactions on Pervasive Computing and Interaction, 2019. 1: p. 204-223.
[42] Serban, I., et al. *Building end-to-end dialogue systems using generative hierarchical neural network models*. in *Proceedings of the AAAI conference on artificial intelligence*. 2016.
[43] Shang, L., Z. Lu, and H. Li, *Neural responding machine for short-text conversation.* arXiv preprint arXiv:1503.02364, 2015.

[44] Gnaneswari, G. and M. Vijayakumar, *Building a Conversational Agent based on the principles of Cognitive Pragmatics using Cognitive Architecture.* International Journal of Engineering Research & Technology (IJERT), ISSN: p. 2278-0181.
[45] Alexandersson, J., et al. *Metalogue: a multiperspective multimodal dialogue system with metacognitive abilities for highly adaptive and flexible dialogue management*. in *2014 International conference on intelligent environments*. 2014. IEEE.
[46] Venkatesh, A., et al., *On evaluating and comparing open domain dialog systems.* arXiv preprint arXiv:1801.03625, 2018.
[47] Zhou, L., et al., *The design and implementation of xiaoice, an empathetic social chatbot.* Computational Linguistics, 2020. 46(1): p. 53-93.
[48] Blum, M. and L. Blum, *A theoretical computer science perspective on consciousness.* Journal of Artificial Intelligence and Consciousness, 2021. 8(01): p. 1-42.
[49] Benotti, L., M.C. Martnez, and F. Schapachnik, *A tool for introducing computer science with automatic formative assessment.* IEEE transactions on learning technologies, 2017. 11(2): p. 179-192.