

A chatbot system demonstrating Intelligent Behaviour using NLP

¹Ameya Vichare, ²Ankur Gyani, ³Yashika Shrikhande, ⁴Nilesh Rathod

¹Student, IT Department, RGIT, Mumbai

²Student, IT Department, RGIT, Mumbai

³Student, IT Department, RGIT, Mumbai

⁴Assistant Professor, IT Department, RGIT, Mumbai

Abstract— Chatbots are computer programs that interact with users using natural languages. Just as people use language for human communication, chatbots use natural language to communicate with human users. In this paper, we begin by introducing chatbots and emphasize their need in day-to-day activities. Then we go on to discuss existing chatbot systems, namely ELIZA, ALICE and Siri. We evaluate what we can take from each of the systems and use in our proposed system. Finally, we discuss the proposed system. The system we intend to develop can be used for educating the user about sports. The database will be fed with sports related data which will be coded using AIML. This system can be used in operating systems in a similar manner to Siri for effective information retrieval just by speaking various queries.

Index Terms— AIML, chatbot, natural language processing, Siri.

I. INTRODUCTION

The need of chatbot systems has become important with the ubiquitous use of personal systems which wish to communicate and the desire of their makers to provide natural language for them to communicate with humans [1]. A chatbot system is a software program that interacts with users using its own language called the natural language. The purpose of a chatbot system is to simulate a conversation with a human which is so human-like that the person gets fooled into believing that he's talking with a human [12]. The chatbot architecture includes a language model and pattern matching algorithms to emulate informal conversation between a human and a system using natural language [3][7].

Initially, developers built and used chatbots for entertainment purposes and used simple keyword matching algorithms to find an answer to a user query, such as ELIZA (Weizenbaum, 1966, 1967). The seventies and eighties, before the arrival of graphical user interfaces, saw rapid growth in text and natural-language interface research, e.g. Cliff and Atwell (1987), Wilensky (1988). Since then, a plethora of new chatbot architectures have been developed, such as: MegaHAL (Hutchens, 1996), CONVERSE (Batacharia, 1999), HEXBOT (2004) and ALICE (2007) [1][2]. With the improvement of natural language processing (NLP) and machine-learning techniques, better decision—

making capabilities, availability of corpora, processing tool standards like XML [1].

In our project we are using AIML. AIML is an XML-based language which can be used for interaction between chatbots and humans. The atomic unit in AIML is category, which consists of attributes called as pattern and template. We are also using a speech to text/text to speech recognition to recognize the Indian accent more efficiently. While constructing the soundbase of the chatbot, the following can help heighten its speech recognition rate: the soundbase should be built to match user speech input based on non-native-specific, area-specific, age-group-specific, and gender-specific parameters [6][14].

II. EXISTING SYSTEMS

A few chatbots with useful applications in our system are presented. We begin by discussing the ELIZA chatbot system architecture and the working. Then we continue discussing about other systems like ALICE [14] and Siri [5].

ELIZA

It was one of the first chatbots, designed in 1966. It acts like a therapist by rephrasing statements of the user and posing them back as questions. ELIZA works by simple parsing and substitution of key words into reframed phrases. People get emotionally caught up by ELIZA's confident replies forgetting that it's a machine [9]. ELIZA was written at MIT by Joseph Weizenbaum between 1964 and 1966. The most famous application of ELIZA was DOCTOR, a simulation of a Rogerian psychotherapist. It had almost no information about human thought or emotion and still DOCTOR sometimes provided a startlingly human-like interaction. When the "patient" exceeded the very small set of knowledge, DOCTOR might prompt a generic response, for example, responding to "I am sad" with "Why are you sad?", a possible response to "My sister hates me" would be "Who else in your family hates you?". ELIZA was taken seriously by several of its users, even after Weizenbaum explained to them that it's not a human [15].

ALICE

ALICE (Artificial Linguistic Internet Computer Entity) is inspired by ELIZA. It is a natural language

processing chatbot—a program that engages in a conversation with a human by applying some pattern matching rules to the user's query and then generating an appropriate response [6][14]. It has won the Loebner Prize, three times. However, the program is unable to pass the Turing test, as even the casual user will often expose its flaws in short conversations. ALICE consists of two parts, Chatbot engine and Language Model. Language model is stored in AIML (Artificial Intelligence Mark-up Language) files. As discussed earlier, AIML consists of pattern and templates. Pattern is used for matching of the user query whereas the response will be provided in template. Following is an example: <category><pattern> how are you </pattern> <template>I am fine</template></category>. In this example, user's input is matched against the pattern and when a match is found, the pattern matching process stops, and the template that belongs to that category is processed by the interpreter to construct the output. AIML has wildcards – denoted by star – which are used for matching a string of one or more words in the input. AIML also has srail (symbolic reduction) tags, which can be used for reducing the amount of pattern and templates. Using srail a number of questions can be grouped and a similar response can be provided in the template [6][7].

Siri

Siri was developed by Apple. Siri is a computer program that works as a virtual personal assistant and knowledge navigator. The feature uses a natural language user interface to answer questions, give suggestions, and perform actions by using a set of Web services. The software adapts to the user's individual language usage and individual searches with continuous use, and returns results that are personalized. Siri was originally introduced as an iOS application available in the App Store by Siri, Inc., which was acquired by Apple on April 28, 2010. Siri has been an integral part of iOS since iOS 5 and was introduced as a feature of the iPhone 4S on October 14, 2011 [5][8]. Siri evaluates your speech locally on your device. A recognizer installed on your phone communicates with a server in the cloud to determine whether the query can be best handled with the information in its databases or if it must connect to the network for an advanced search [13].

III. ISSUES IN EXISTING SYSTEMS

We discuss the issues of the existing systems (discussed in previous section) in this section.

After close observation of A.L.I.C.E chatbot system it is apparently clear that (a) ALICE does not save the history of conversation and (b) ALICE does not truly understand what you said; it gives you the responses from the knowledge domain stored in her brain.

After close observation of voice-to-text agents like Siri it is clear that (a) At times Siri can't understand what we told her to do and (b) Siri cannot answer for complex queries. For eg, Siri knows "Where was Abraham Lincoln born?". It also knows "What is the population of Kentucky?" but it would

fail if someone asks "What is the population of the place where Abraham Lincoln was born?".

IV. PROPOSED SYSTEM

We propose a system which will work as an application and give users information about different kinds of sports present in the world. This application will work using a pattern matching algorithm using depth first search (DFS). It will also convert user's queries from speech to text using a speech-to-text converter and back to speech as an output to the user. Firstly, the user will speak his/her query out loud; the application will convert this query from speech into text. The system finds out what the user actually wants by retrieving the semantic meaning of the query. Then the system will pass on this semantic text as input to the pattern matching algorithm. The pattern matching system will make use of knowledge that is already fed into the databases in order to generate a response. Once this response is generated we will convert it back into speech and the application will read the content out.

V. DESIGN

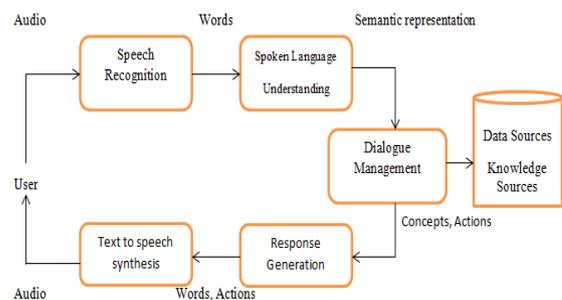


Fig 1: Block Diagram of proposed system

The user will speak out his query on his/her phone using the application system. The application sends this speech as input to the speech recognition module which will convert the speech into text. This will be implemented using Google speech recognition API. There are two ways to do so, using RecognizerIntent or by creating an instance of SpeechRecognizer [6]. Normalization is applied for each input, removing all punctuations, split in two or more sentences and converted to uppercase. E.g.: Can you, or can you not do this? is converted to: CAN YOU OR CAN YOU NOT DO THIS. The spoken language understanding module will understand the meaning of the query using semantic representation. This is done so the application system can recognize what the user actually wants. Semantic representation of a query will help the system realize the connotation as well as denotation of the query. Semantic representation is implemented using either of two methods, orthographic similarity or phonetic similarity [10]. Confidence levels, placed in arrays, are assigned to queries to know if what the user spoke and what the system understood are the same thing. Confidence ranges from 0 to 1, with 1 being most desirable. This refined form is then fed to the dialogue management module. This module will make use of the knowledge already fed to the knowledgebase as well as the various web services in order to generate a response

which will be appropriate to the query asked. The knowledge base will be fed a set of prior information about sports related questions using AIML. In the response generation module, the pattern matching algorithm uses DFS to match a query and it continues till a match is found [11]. The interpreter processes the template that belongs to that particular category and generates the output. System appends the constructed output as input to the text-to-speech synthesis module. The response in form of speech which is generated will get fed to the user as input in the form of words. The conversion of text back to speech is implemented using Google text-to-speech synthesis. We use Google TTS synthesis by importing the package android.speech.tts [6]. System prompts the user to ask if he has another query. If the user has another query, the system will repeat the entire process again otherwise the system will terminate processing.

VI. CONCLUSION

To summarize, we have learned about all the existing systems which included ELIZA, ALICE and Siri. We found out ways in which these systems can influence our system. ELIZA helped us understand how reframing the questions will make the conversations more human-like. ALICE helped us understand how we can make use of AIML in our system. Finally, Siri helped us understand the limitations of language processing in speech to speech agents. We decided to build a system to implement natural language processing on Android OS. In this system, the user will be prompted to ask a query which is related to sports. The user will speak out his query on his/her phone using the application UI. A range of sports related questions and their responses will be coded into AIML and stored into the database. When the user will ask a query, this query will be matched against the various patterns present in the database and the template corresponding to that pattern will be returned in form of speech to the user.

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