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Web based chatbot

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Abstract: Chatbot is a smart intelligent program which is widely popular now a days in application of computer communication. This paper addresses about the architecture, design and implementation of a chatbot application program. We will also be studying the techniques involved in designing a chatbot and the wide applications of chatbot in the web application domain as smart virtual assistant.

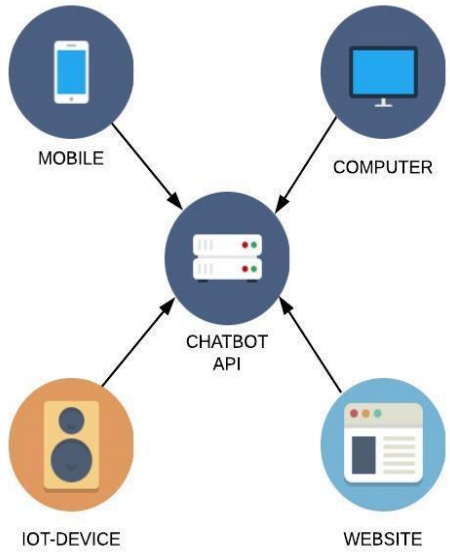
Keywords: chatbot, pattern matching, Natural language processing, query, response.

1. INTRODUCTION

Today our lives have become very heavily dependent on the digital media like mobiles, computers and on computer applications like search engines, smart assistants, and various communication applications. Also, speech is a powerful medium for interaction than text is and plays a significant role in our daily communication and is a very useful and important feature in any application. One such application is chatbot. Chatbot is an intellectual program which provides for an effective smart communication via textual or auditory media. It provides a response for an inquiry made by a human user. Chatbot broadly work on the basis of Natural language processing (NLP) and pattern matching. Chatbot uses Natural language processing to process and convert the auditory speech into a format which can be understood by the chatbot application. After this, Chatbot recognize the user input and then access information from the predefined keywords in the database for the provision of an output or reply. For example, if the user input to the chatbot is "What is the weather today" then the reply of the chatbot should be like "today's weather is 31°C" [1]. Chatbot also checks for the order of words, grammar and predefined stored exclusive variables in the sentence. In this paper, we will be studying the methods and techniques involved in the designing of chatbot application and its implementation. [2] We will also be studying about its various applications in the modern world and about its future scope in the field of AI and machine learning in paper.

2. ARCHITECTURE

The key focus point of the application is to develop a web api of our chatbot that can take a query and process it in order to return the desired result. Developing an API makes the application compatible with any device that can be connected to the internet and able to make the get post request to our web server.



The user interface part is client side rendered and will be responsible for the tasks like converting speech to text and vice versa in order to send the query to the web server using post method.

The process to the speech to text and vice versa is carried out with the help of Web Speech API which is supported by the browser the API is accurate and provides everything that we need to build our application.

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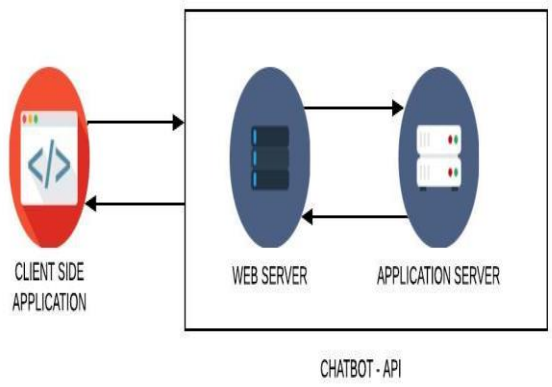
The Web server that handles the request processed by our API is divided into mainly two parts web server and application server. The first part majorly handles all the request coming and the response going to and from the servers. The second part handels the Natural Language Processing it's the approach we are using to extract the meaning out of the query sent to the server. Many techniques are used to extract the meaning like filtering stop words like is, am, are, the than we pass the result to a lemmatize function which convert the words to 1st form of verb for example "paying to pay". Based on the result obtained we execute different switch cases which allow us to obtain the required data from different sources and club them together in order to prepare the response that will be sent to the client in order to display it as the response to the user query. Shown below is the diagram how the architecture of the application looks like.



In this way the query made by the user is hadelled and the result than sent to the user as the reply to their query this whole process of interaction with the user with not only the a simple statement but with the data also make the chatbot application more useful and helpful for many people.

3. IMPLEMENTATION

The research done which is analogous with Chatbots can be taken as substantial. It can be said that Chatbots have latterly become a propitious technology for machine to user understanding and interaction. Using this technique, scripting- systems have been developed to satisfy a huge number of applications which are very diverse in nature showcasing its ability to be implemented in various fields.

The data received from the end user is of the form of text in any human readable language. Here, the language of choice is English which is to be used in out chatbot.

Now, this data in the form of text has to Formulated prior to being used by any computer algorithm. In order to do this, a series of steps have to be followed. This whole process of response generation can be acknowledged in terms of multiple stages/phases.

The first phase involves the breakdown of the user query can store it in a more efficient form which is not enough to understood by the machine but can help in the pattern matching process.

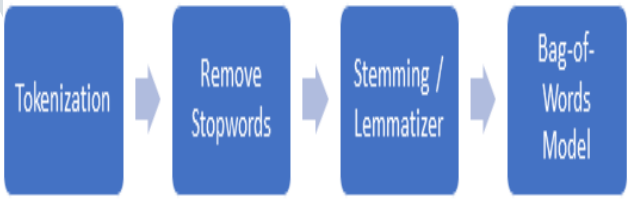


Figure 1

The first step of this phase is Tokenization which is the most initial step that has to be taken under NLP(Natural Language Processing). This process is very well endowed under Lexicography which is the process of analysis and construction of Word based Dictionaries. In this process, the user query is broken down in the form of tokens. Further, A tokenizer can be broken down into 2 categories namely Word Tokenizer which is the process of breakdown of words from sentences and Sentence Tokenizer which is the process of forming tokens of sentences form a given paragraph. In English language, different words are separated by the means of blank

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spaces and full stops are used to end a sentence which also indicates to the beginning of a new sentence[3].

The next step which we have to process is Removing Stopwords . The english language has a lot of words which are required for the proper construction of a sentence but does not change the meaning of the sentence [1]. The use of these words is to make the sentence grammatically correct.

Stemming - The words that we come across in any language are usually inherited/derived from other words which are called their root/base words. This whole structure of a word and its hierarchy can be seen a tree and this step can be viewed as reducing the word to its stem form from which the branches are derived. Also, the meaning might get deviated while performing this step as multiple branches can be parented by a single stem i.e more than 1 word can have the same stem[6].

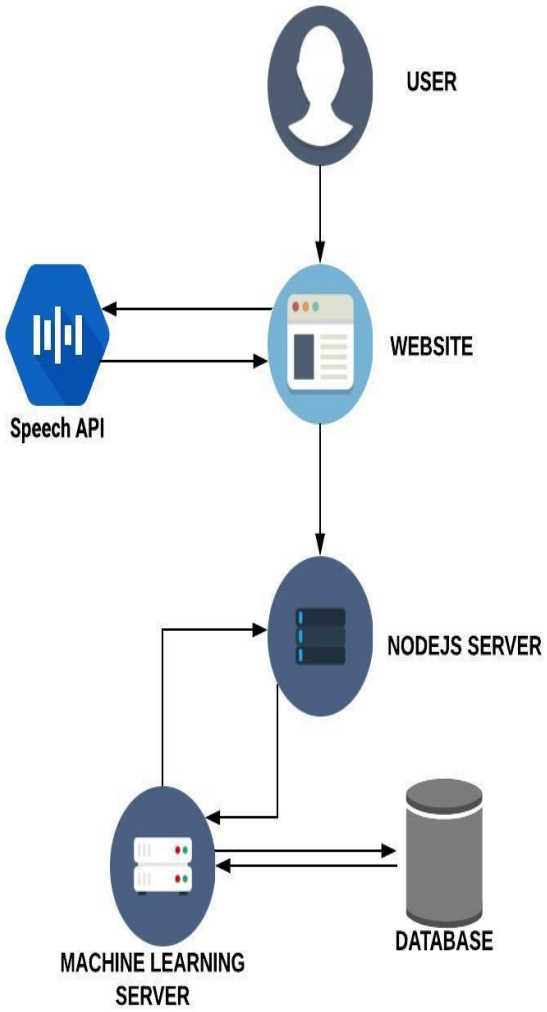
Stemming can be implemented by various techniques, some of which are a) Porter Stemmer b) Snowball Stemmer c)Lancaster Stemmer.

Lemmatizer- This is the technique of clustering together the derived/inherited versions and even the synonyms of a single word making it possible to process all the words as a single item. WordNet is the most widely used Lemmatizer and the same has been implemented in this project[2].

The purpose of Stemming and Lemmatizer are the same but the usage of Lemmatizer is prefered over Stemming due to its better interpretation of the words as while stemming is considered with handling the suffix and prefix of the word, Lemmatizer connect words with their actual meaning which yields better results.

Bag Of Words: It is a crucial step in forming a inference of the text in a machine understandable form. The initial step is the formation of a list of unique words (Processed by the initial stages) and forming a vocabulary of the query/language. Now, while the list of words is created, their subsequent frequency of occurrence is scanned in the text and is stored while being linked to the word[8].

Following the above guidelines, a table is created where the attributes are individual words in the text while the tuples are the subsections of the text i.e individual queries raised by the user and their corresponding frequencies.



In order to make a working project based on the above architecture the use of several technologies is required. This application uses many languages like javascript, python, html, css etc toby the make the chatbot possible.

The application is divided mainly into two parts client side and server side. The main job of client side part is to convert the text to speech and send the query to the server and when the response from the server is received, it is able to render the result such that it is useful for the user or client. Client side application uses technologies like html, css, javascript in order to send the data and to convert the voice to speech and vice versa it uses the Web Speech API developed by MDN which uses device

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microphone to record the voice and has two methods one for the speech recognition which recognizes the voice content from the audio input provided by the user. The second method of the API uses the SpeechGrammar interface that contains some grammar rules that helps in extracting better meaning out of the voice. The application also uses the SpeechSynthesis interface in order to convert the text-to-speech.

The server side part of the application mainly uses two technologies NodeJs and Python. NodeJs help in creating the web server using the express which is the web framework for the NodeJs helps in creating the Web API and other web services required by the application. The main task of the web server is to receive the request from client side application and than provide the data to the application server. Application server than process the query and gives the result to the NodeJs application than on the basis of various switch cases the NodeJs application fetches and organises the data like news, weather, general reply etc based on the query. This result than transferred to the application server which send the data back to the client as the response to the users query. The data transferred and received is in the form of the JavaScript Object Notation (JSON). The NodeJs needs to be connected to the python which handles the application server part of our application. Inorder to transfer the data to the python, compile and run the python files from the Node application. This is possible using the npm package called the python-shell. Python-shell uses the installed version of python for which we have to provide the path where the python is installed in our system and the path which contains our python script.

On the other hand the Python helps in creating the application server, which helps with the natural language processing part of the project. Natural language processing is implemented with the help of Natural Language Toolkit (nltk) which specifically built to work with the human language. We have integrated nltk with the help of pip which is the python package manager.

4. FUTURE SCOPE

While a chatbot can be referred to as a "Virtual Assistant" , the limitation of application which it is bounded by is very vast. Which swirling through enormous amount of data and providing the machine to understand, analyse and process it, we can apply this concept on business, education, medication and ease of access of services. With this technology, we can store data in database/data-warehouses and use a chatbot to make queries which can be a great educational tool [3]. We can even form expert systems using chatbots if our data is of significant authentication and value. The Business Intelligence of an organization can be improved by forming guidance systems using flow-based chatbots in order to facilitate efficient decision making process [2]. Also, chatbots applications can be used for entertainment-based purposes. Existing softwares like Siri, Cortana etc are very highly entertained by users. Chatbots can even be used to fight depression and loneliness among people who find it difficult to interact with other humans which can even lead reduction in suicides. With the advancements done and being performed in this technology, its really hard to envision a prospective without chatbots.

5. CONCLUSION

A chatbot can have wide range of functionalities from usage in conversational applications to virtual personal assistance in applications. Virtual personal assistants give response or information to your query in text or speech. Chatbot can have multiple methods to give response to a request or query using pattern matching and natural language processing. This paper presents the Architecture and implementation of chatbot which involves the use of Web development and Machine learning. Though the paper suffice information and techniques for the implementation of chatbot, there can still be various features which can be added on due the variety of techniques and methods available on different technologies [2]. A chatbot is a great interaction tool, providing us with features from providing entertainment media like videos to providing useful information like news and saving the user time by finding answers to questions which are hard to find. In this project, we came to know the approach, architecture and implementation of chatbot and how they can be further developed [1]. We also studied about the various applications of chatbot in the field of web development and various others. The basic approach in designing a chatbot must consider user satisfaction, user experience, neatly packed knowledge base, high performance and less resource utilization and fast response architecture. Although, Some chatbot applications have widely been popular and used, It can be designed and developed using various approaches which can have problems in finding a common approach in commercial sector and improvements should be made in

finding a common approach in building chatbot applications.

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