

CureBot -An Artificially Intelligent Interactive Bot for Medical Diagnostics

Vaibhav Tode¹, Himanshu Gadge², Sudarshan Madane³, Prateek Kachare⁴, Anuradha Deokar⁵

¹⁻⁵Department of Computer Science, All India Shri Shivaji Memorial Society COE, PUNE-1
Savitribai Phule Pune University, Pune, Maharashtra, India

Abstract - An **Automated System** which is intended to interact with humans is termed as a Chatbot. The agent interacts with the users and supply responses to the queries. The Chatbot has the self-learning capacity which may easily understand the input and provides the specified output to the user. The bot creates its own Database within the run time while the training face from which it recognizes various patterns and by that it gives specific prediction to the specified query. The bot communicates with the user for the input & gives the output by making use of its algorithms and Prediction Analysis. The primary level of processing in our architecture deals with audio I/O. When a user makes a question, the user query is converted from audio input into Text, and this is often said as Speech-to-Text. Within the second level of processing, the extracted text is employed as a basis for performing language Understanding on the generated text to decode the semantic meaning of the user input and recognize morphemes. Within the case of a talking interface, this is often considered the primary level of processing because of the absence of the requirement for audio-to-text conversion. The Curebot can be used by medical practitioners to connect with their patients during any emergency help. This bot has the potential to help by permitting patients to receive supportive care without having to physically visit a hospital by using conversational Artificial intelligence-based applications for their treatment. The study helps as a Computer application acting as a personal virtual doctor that has been designed and trained to interact with patients like human beings. This application provides treatment based on symptoms conveyed as per the patient's need and illness.

Key words: Automated System, Chatbot, Self-Learning, NLP (Natural Language Processing), NLU (Natural Language Understanding), Morphemes

1. Introduction

An **Automated System** which is intended to interact with humans is termed as a Chatbot. The agent interacts with the users and supply responses to the queries. The Chatbot has the self-learning capacity which may easily understand the input and provides the specified output to the user. The first chatbot was created by Joseph Weizenbaum in the year 1966, he named it "Eliza". Chatbots are used in operating systems as automated systems or virtual assistants such as "Cortana" in windows and "Siri" in mac. The popularity of these chatbots in the business sector is increasing day by day as they have huge potential in automating client service and

reducing the efforts of humans in terms of work. These advancements in the chatbot, where conversations with the chatbots have become as normal and natural as with humans.

Nowadays, almost all companies have their chatbots to engage their clients and serve users by solving their queries or problem. These bots can be used for acquiring knowledge. These can be implemented on our mobile phones and local PC. It can access the internet. These bots communicate with users in any domain with queries as input in the general conversational statements. When the client starts asking questions on any topic and the discussion begins from there, the chatbot returns the output and starts answering their queries. Chatbots are the software entities which act as a human entity [1].

There are many types of chatbots available, a few of them can be classified in terms of Text and Voice:

- **Text-based chatbot:** The chatbot answers the user's query via text interface or display.
- **Voice or Speech-based chatbot:** The chatbot answers the user's query via a human voice recognition interface.

There are two techniques used to design the chatbots, classified as follows:

- **Rule-based Approach chatbots:** A chatbot answers the queries based on some rules on which it is trained on. The rules can be very simple to very complex. The chatbots can handle simple queries but fail to manage complex ones.
- **Self-learning chatbots:** These chatbots use some Machine Learning-based approaches and are definitely more efficient than the rule-based chatbots.

On the basis of the above techniques, these chatbot can be further classified into the other two types are Retrieval Based or Generative Chatbot.

The chatbot depending on the complexity, a few of them can be classified as follows:

- **Traditional chatbot:** The chatbots which are driven by the system and automation, mainly through the scripts with minimal functionality and the ability to maintain only system context is known as Traditional chatbot.
- **Current chatbot:** The chatbots which are driven by the back and forth communication b/w the system and the humans are known as the Current chatbot. These bots have the ability to maintain both systems as well as task contexts.

Future chatbot: The chatbots which can communicate at multiple levels with automation at the system level are known as Future chatbots. These bots have the ability to maintain the system, task as well as people contexts.

2. Background and Related Work

[3] This paper Describes that Chatbots are more fascinating compute user interfaces that have been risen in popularity. Examples include ELIZA, which is a program that simulates a psychotherapist, PARRY- a chatbot that simulates paranoid patients by studying the nature of paranoia. More other types of chatbots are available on the web such as Mitsuko (a chatbot designed for entertainment) which cannot solve user's problems. It's the type of chatbot when one needs someone to talk to.

Chatbots have good conversational abilities they are good at emulating a human conversation, and they learn through knowledge [3]. The most recent robust chatbot that has minimized a lot of human work includes Apple's SIRI, Amazon's ALEXA, and Google Assistant.

According to [7] AIML (artificial intelligence markup language) is the most popular language for the definition of a chatbot knowledge base. An interpreter must guarantee the compliance of properly formed AIML documents, perform preprocessing duty for correct usage of the bot and also ensure the correctness of pattern matching of user input and chatbot response. A chatbot can extend daily lifestyles like automation in telephone answering systems, education business, and e-commerce. Chatbot designers aim to help people by designing work efficient chatbots for them. Chappie is being used as a routing agent in which it can easily classify requirements of a user into one of the services provided by a business based on the first few chats and then transfer it to an expert agent based on that service. After this comes to a Banking chatbot which provides an answer to a query of the student very effectively. Students just need to put their query to the bot which is used for chat purposes. Then the system uses AI-based algorithms to give appropriate answers to the users. If any of the answer is found to be invalid then some system to declare the answer invalid can be carried out. These Invalid answers then can be deleted by the admin of the particular system. Then comes the AI Web-Based Chatbot which acts as a personal assistant which in turn stimulates and initiates the meetings of the

user. The exchange of information takes place via email conversations whereas its evaluation is carried out by NLP and NLG (Natural Language Generation) and AIML files. This system achieved 70% efficiency and has proved to be implemented in the real world.[7]

Said, Gartner in [4] articulated that there will be an increase in acceptance of Mobile Apps and that by 2020 the use of these Mobile Apps will be used to seek virtual assistance from Chatbots. Another estimation made by Gartner stated that by 2020, 25% of customer service communications will be handled by Chatbots, and by 2021 more than 50% of businesses will spend on Chatbots [4]

In addition to that, Business Insider [5] articulated that 80% of businesses will automate most of their processes in the form of Chatbot technology [5]. In the banking and insurance sectors, Foye [6] predicted that by 2022 there will be \$8 billion cost-saving per year when Chatbots are utilized [6].

[8] The paper articulates an application "Aapka Chikitsak" is developed especially for COVID-19 to provide users healthcare consultation, counseling, and information with multi-lingual support (for now, English and Hindi) to improve the healthcare and well-being of the growing population in India and continue provision of healthcare access at ease post the lockdown as well. It provides information about the majority of diseases prevalent in India along with their possible symptoms and allied measure to cure the same. The same also provides interactive counseling sessions for emotional support and expectant mothers. Based on the above it also provides local food recommendations on diet depending upon the geographical location of the user. The user commands his query via speech which is then taken up by the bot and it gives appropriate remedies for the same. [8]

3. Analysis of Related Work

In this section, CureBot Is a Computer Program that is designed to treat ill patients accordingly. Patients can communicate with this tool using voice or typing available with multi-lingual support. So, the first step towards implementing Chatbot is to settle out for DOMAIN. And AI is the best suit for performing a task using Human Intelligence.

Now, what is HUMAN INTELLIGENCE and ARTIFICIAL INTELLIGENCE?

Well, we can say decision making, speech recognition, or translation of languages is Human Intelligence. Artificial intelligence gives the human ability to a chatbot to perform and soothe a task. An Important element used in Artificial Intelligence is Machine Learning.

Machine learning helps Chatbot to learn from queries and data provided by the user. ML monitors the command given to a bot and acts accordingly.

In this section, the actions performed by AI Bot is for the well-being of patients. This chatbot with AI power makes the bot more powerful in solving patient's queries and give them appropriate treatment for their disease and symptoms. This Bot has the ability to recognize the problem faced by a patient, as a patient has various options to convey their problems through speech or typing in their own language. Bots using AI and ML are more efficient and intelligent to understand and solve the patient's queries. As Chatbot interacts, it gains more knowledge. They learn from the interactions that happened with patients. And this helps them to improve their response.

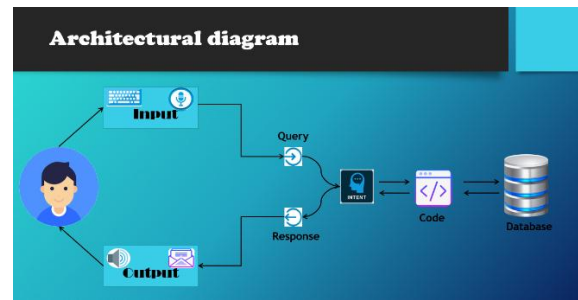
One of the major challenges India is facing is to serve the nation with medical facilities and good quality healthcare. India has slipped 10 places and now stands 68th as per WHO reports. India in means of transport further causes postpone in treatment and are not cost-efficient and more reliable. Poor people living in villages or rural areas or farmers are unable to take the full benefit of medical facilities due to financial issues or traveling facilities and expenses. To seek more efficient ways to provide timely medical care, access and quality treatment to the patients, the role of AI bot mention in this section comes into play which connects patients with healthcare providers and healthcare information.

Our software covers the most prevalent disease all over India with a special emphasis on rural parts. Our facility imparts the services of a doctor by providing preventive measures, symptoms, and healthcare tips. Our software will be extremely beneficial and provide efficient and instant solutions to those needs.

4. The Architecture of CureBot

In recent years, serverless architectures (Functions -as-a-Service) are gaining traction as an alternative way of providing backend services without requiring a dedicated infrastructure. Serverless allows its users to deploy their stateless functions into platform infrastructures. This stateless behavior makes every invocation independent of the previous runs. For our application, **Firestore** and **Google Cloud Platform** as our backend infrastructure is provided.

Our conversational bot is AI powered and based on a serverless architecture. It is embedded with **Natural Language Processing (NLP)** and **Natural Language Understanding (NLU)** to understand the user's query and return respective responses. NLP facilitates to read, decode, understand, and make sense of the human languages. The first level of processing in our architecture deals either with audio or text I/O.



When a user makes a query in audio form, the user query is converted from audio input into text and displayed on chat window, then that query is extracted for further procedure but, if a user makes a query in text format, then that query is directly extracted. In the second level of processing, the extracted query is used as a basis for performing Natural Language Understanding on the generated text query to decode the semantic meaning of the user input. The intent mapping is performed by Dialog flow agent that has been trained on an annotated corpus of training phrases to allow it to find inferences.

For this Chatbot, cloud functions are used for firebase to create a Webhook (one of few ways web applications can communicate with each other). The Webhook request is fulfilled through the deployed cloud function on Google Cloud Platform and this service sends a webhook response message to dialog flow. The response message consists of the response that should be sent to the user. Further, the text response is again converted to speech (Text to Speech) and returned to user.

5. Algorithm and Sequence Flow

NAÏVE BAYES is a machine learning model that is used for plenty of Data. It is a fast and easy Classification Algorithm. Natural Language Processing is a field of Computer science, Artificial Intelligence, and linguistic concerned with interactions between human language and computers. Naïve Bayes gives excellent results when it comes to NLP tasks to process and analyze large amounts of natural language data.

The algorithm used for the implementation of a Bot is MULTINOMIAL NAÏVE BAYES which is a type of Naïve Bayes Algorithm. It is widely used in text classification in NLP.

Conditional probability:

$$P(A | B) = \frac{P(B | A) \cdot P(A)}{P(B)}$$

Bayes theorem works on conditional probability. This can give us the probability of events using prior knowledge.

P(A): - The probability of hypothesis H being true.

P(B): - The probability of the evidence.

$P(A|B)$: - The probability of the evidence given that the hypothesis is true.

$P(B|A)$: - The probability of the hypothesis given that evidence is true.

It is extremely fast compared to sophisticated methods.

Pseudo Code: -

Step1: - Begin.

Step2: - Read training dataset (C, D)

Step3: - $V \leftarrow$ Extract Vocabulary (D)

Step4: - $N \leftarrow$ CountDocs (D)

Step5: - for each c belongs to C

Step6: - do $N_c \leftarrow$ CountDocsInClass (D, c)

Step7: - $prior[c] \leftarrow N_c/N$

Step8: - $text_c \leftarrow$ ConcatenateTextOfAllDocsInClass (D, c)

Step9: - for each t belongs to V

Step10: - do $T_{ct} \leftarrow$ CountTokensOfTerm ($text_c, t$)

Step11: - for each t belongs to V

Step12: - do $condprob[t][c] \leftarrow \frac{T_{ct} + 1}{\sum t'(T_{ct'} + 1)}$

Step13: - return V, prior, condprob

6. Proposed Methodology

The proposed model of our chatbot works as a client server based web application. The web application will be used to serve as the front end as well as backend and the bot will learn to respond on the server.

Our system will aim at getting the inputs from the user and displaying the generated output. The user will have to provide basic contact details. The details would consist of name, contact number, email address. This information provided will be used for further communication if required.



Fig: Sample chat Bot

7. Advantages

- Understand unique query.
- Personalize response.
- A Chatbot can result in productivity as they are convenient 24*7 and reply quickly.
- Cost-saving
- User friendly
- Language support
- Data gathering
- Reduced operational cost and improved morale

8. Drawbacks

- Cannot perform physical operations
- The robot does not work without the user prompting first
- Requires time to time maintenance
- Internet connectivity

9. Conclusion

Keeping in mind, the situation of the poor and rural population and the imbalance between the demand and healthcare services currently provided, so by deploying this CureBot will try to bridge a gap by creating a multilingual conversational application with Natural language Processing. This is one of a kind personalized healthcare bot which is sensitive to the needs and understanding of the Indian rural population and provides generic healthcare information along with prevalent diseases.

References

- [1] N. Albayrak, A. Özdemir, and E. Zeydan, "An overview of artificial intelligence-based chatbots and an example chatbot application," 2018 26th Signal Processing and Communications Applications Conference (SIU), Izmir, 2018, pp. 1-4. : 0.1109/SIU.2018.8404430
- [2] Introduction to Chatbot | Artificial Intelligence Chatbot Tutorial
- [3] Katlego Mabunda and Abejide Ade-Ibijola. PathBot: An Intelligent Chatbot for Guiding Visitors and Locating Venues.

2019 6th Intl. Conference on Soft Computing & Machine Intelligence

[4] Gartner. Gartner says 25 percent of customer service operations will use virtual customer assistance by 2020.2018.url - <https://www.gartner.com/newsroom/id/3858564>.

[5] BusinessInsider. 80% of business want chatbots by 2020. 2016.url - <http://www.businessinsider.com/80-of-businesses-want-chatbots-by-2020-2016-12>.

[6] L Foye. Chatbot conversations to deliver \$8 billion in cost savings by 2022. juniper research. analyst xpress, 2018.

[7] Sooryaprakash Pandey, Suraj More and Rachna More. Artificial Intelligence Based Chat-Bot. International Journal of Research in Engineering, Science and Management Volume-1, Issue-9, September-2018

[8] Urmil Bharti, Deepali Bajaj, Hunar Batra, Shreya Lalit, Shweta Lalit and Aayushi Gangwani. Medbot: Conversational Artificial Intelligence Powered Chatbot for Delivering Tele-Health after COVID-19. Fifth International Conference on Communication and Electronics Systems (ICCES 2020)

[9] Urmil Bharti, Deepali Bajaj, Hunar Batra, Shreya Lalit, Shweta Lalit, Aayushi Gangwani "Medbot: Conversational Artificial Intelligence Powered Chatbot for Delivering Tele Health after COVID-19" the Fifth International Conference on Communication and Electronics Systems (ICCES 2020) IEEE Conference Record # 48766; IEEE Xplore ISBN: 978-1-7281-5371-1

[10] Aafiya Shaikh, Dipti More, Ruchika Puttoo, Sayli Shrivastav and Swati Shinde " A Survey Paper on Chatbots" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072



PRATEEK KACHARE
BE COMPUTER
AISSMSCOE,PUNE



SUDARSHAN MADANE
BE COMPUTER
AISSMSCOE,PUNE



HIMANSHU GADGE BE
COMPUTER
AISSMSCOE,PUNE



ANURADHA DEOKAR
ASSISTANT PROFESSOR
AISSMSCOE,PUNE

BIOGRAPHIES



VAIBHAV TODE
BE COMPUTER
AISSMSCOE,PUNE