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Design and Development of Conversational Chatbot for Covid-19 using NLP: an AI application

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***Abstract*—Since the discovery of corona virus (nCOV-19), and its subsequent progression into a global pandemic, an enormous hurdle faced by hospitals and their healthcare staff has been to streamline, and look after the huge flow of cases. It has become increasingly difficult to consult a Covid specialist when the first wave occurred in rural and areas not connected as well to modern amenities. Thus, it has become obvious that an interactive Chatbot with efficient execution can help patients living in such areas by educating on the appropriate preventive measures, news on virus strains, reducing the psychological damage caused by the fear of the virus and mental effects of solitary isolation. This study displays and discusses the schematics of an artificial intelligence (AI) chatbot for the purpose of evaluation, diagnosis and recommending immediate preventive as well as safety measures for patients who have been exposed to nCOV-19, and doubles as a virtual assistant to aid in measuring the severity of the infection via symptom analysis and connects with the authorised medical facilities when it progresses to a serious stage.**

***Keywords*—Chatbot, Artificial Intelligence, Natural Language Processing, Conversation agent.**

I. INTRODUCTION

Conversation can be defined as exchange of information via communication between two or more entities/people which improves upon the knowledge amongst them. The exchange of thoughts and ideas is a key feature of communication and listening to each other. With this key concept in mind, technological leaps in artificial intelligence have led to developing technologies which involve an AI which can communicate with humans naturally, maintaining the flow of human conversation. While a basic computer program which acts as an automated conversation agent is also referred to as a Chatbot, this paper concentrates only on text-based conversation [1]. Such systems can autonomously develop and learn knowledge using supervised (assisted human aid) or unsupervised (using web resources). This is a very fundamental application as the data is stored in advance. The system application uses the question-and-answer protocol in the form of a chatbot to answer user queries as shown in "Fig. 1". The key objective is to reduce healthcare costs and client usage time, as it might not be possible for the users to visit doctors/experts on urgent need. Question responses are generated based on the queries input by the user and the database. Keywords of feasible significance are fetched and output as the answer to input query is generated [2],[4]. If a match is generated with high enough significance, the corresponding answer will be displayed to the user. Questions requiring answers of much higher complexity can be categorized and answered by a medical expert. Users can ask any number of questions regarding medical management, and not much time will be wasted by the user in consulting a doctor [2]. These applications are accessed via a website or WhatsApp and Facebook and other such social media applications. For instance, the World Health Organization (WHO) Technology program developed a chatbot to in light of COVID-19; which was very widely accessible due to its presence on WhatsApp and Facebook. Its users were able to use its features to answer their queries and take better measures to protecting themselves from COVID-19 and access facts related to the diseases and prevention measures[3]. Furthermore, it is the goal for future health-based AI virtual assistants to not be bound by a user query model but extend using innovative technologies to assist consumers in appointment scheduling, providing medication adherence guidance and being health consultants. Experts anticipate AI-based technologies will have humanlevel intelligence by 2029 and are expected to exceed human intelligence by 2049[5],[11].

II. LITERATURE REVIEW

This section of paper aimed to present the review on the current literature on COVID-19 related Chatbot in healthcare, identify and characterize these emerging technologies and their applications for combating COVID-19, and describe related challenges [1]. A sophisticated AI medical Chatbot has been discussed in this paper for users, especially during

unknown pandemics like nCOV-19. At present, the proposed Chatbot in this paper is in design phase, which will be followed up by total design into code soon, with plans to launch this app in the next few months, by developing this Chatbot engine in Python, and Watson as the AIML platform. After releasing this bot into the market, based on user feedback, further updates will be made for at least 3–4 months. Once this COVID-19 pandemic is over, plans include reusing this conversational agent and making it compatible to handle a wider range of epidemics or other services with individual APIs and relevant datasets [3],[12],[13].

The process to build a chatbot using a tool called Bot Framework Composer was developed which is part of the Bot Framework ecosystem for building chatbots using a graphical user interface instead of programming a chatbot using code [4]. K. Mazidi and P. Tarau in 2016 analyses the central semantic content of each sentence and discusses how natural language processing can be combined with natural language generation [6]. G. R. Villanueva, 2020 presented a system (Chabot which can build a FAQ Chatbot for institution deal with higher education which was a dynamic framework [7]. Rarhi et all in 2017 presented a chatbot which aims to develop a system which identifies the symptoms and suggests help on the basis of the same. It takes into consideration the severity of illness and based on that; it provides a list of doctors on an online platform [8]. Wojciechowski in 2013 presented a framework EETL which handles the ETL Layer which shows the process of servicing ETL flow with the help of case-based reasoning and proposes an algorithm for evaluating ETL workflow process [9]. Milan, 2021 presented a (Four language) based models which can work for Nepali covid19 tweets using for sentiment analysis. The proposed system assists firms in adapting to the changing climate [11].

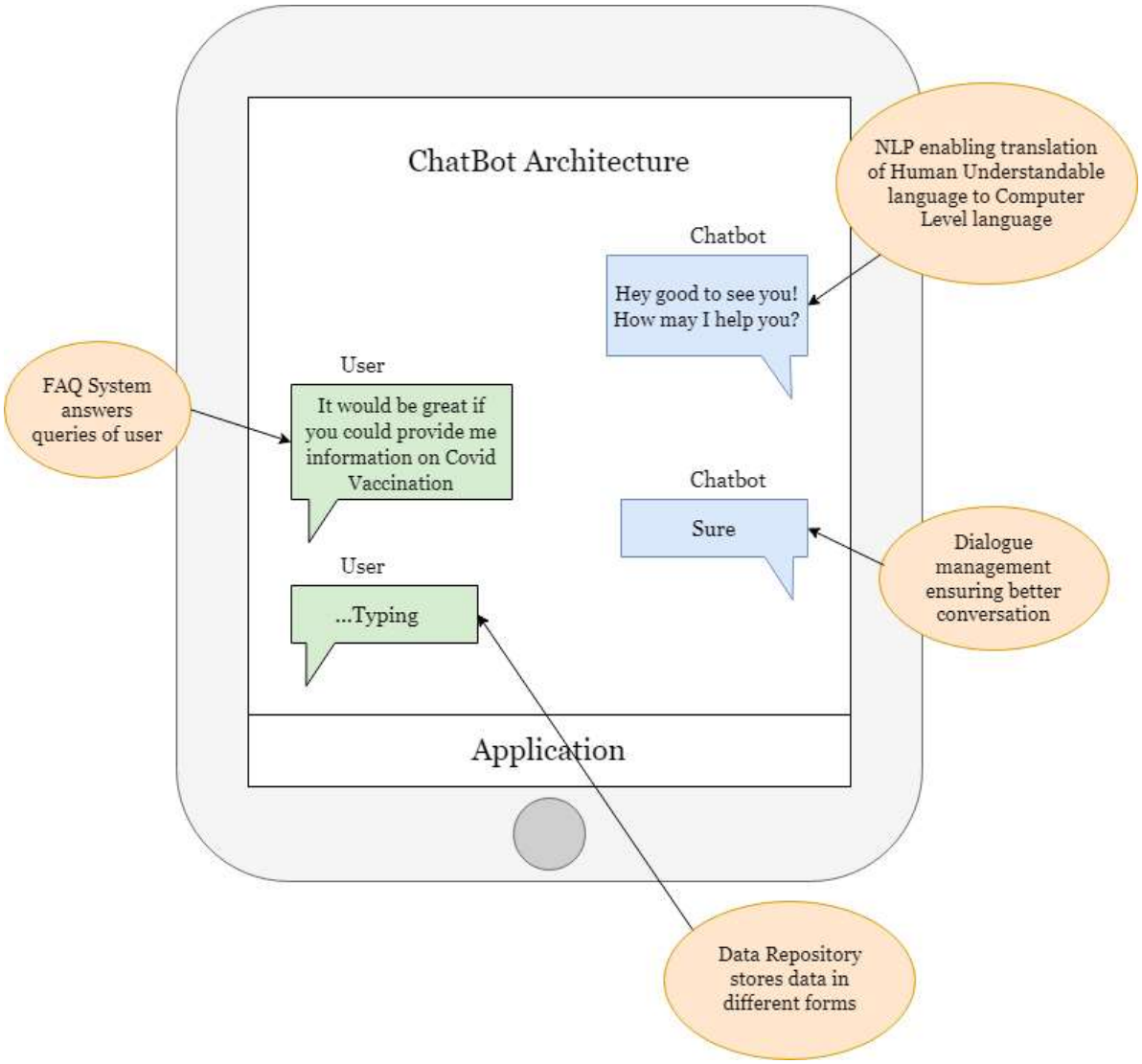

Figure 1 Conversational Chatbot User Interface

III. PROPOSED ARCHITECTURE

With the changing era of advancements, people and their needs too are changing. One such need is in the field of medical health. Access to healthcare resources is one of the basic rights of every human present on the planet but sometimes due to lack of medical staff or trained personnel it gets denied. Also, it was observed during COVID-19 how the insufficient medical resources and assistance resulted in distress around the world. Since the beginning of the pandemic, it was also observed that due to rumours and irresponsible theories led to confusion among the general public regarding various facts about the symptoms, treatment, medications, aftereffects, vaccination and other things related to the disease. Especially for diseases like novel Coronavirus whose variants are still mutating, and the virus is still under the study by the researchers for unveiling of essential knowledge related to it, updated and assured information is of prime importance. Since 2020 all witnessed how COVID-19 impacted communication and mobility of people and the concept of AI Chatbots entirely fits to fulfil the medical needs of the general public. The proposed architecture of conversational Chatbot can be utilized in the medical field specifically as a COVID support system due to the features and abilities. The AI chatbot is designed to help the user with queries related to COVID-19, information of vaccines, reference for medicines and other resources as per the expert suggestions and recognition of symptoms based on user inputs. The architecture also aims to reduce the workload on the medical professionals and share their burden by providing the patients with required medical help. The architecture emphasizes on different components involved and how they contribute towards the working of the chatbot. It depicts how input from the user after undergoing various processes is able to produce suitable outputas represented in “Fig. 2”. In this paper the proposed architecture for a conversational AI Chatbot were discussed that can be used in healthcare sector specifically for COVID -19. Various components of the proposed model of AI Chatbot are:

- NLU Processor
- Dialogue Management
- FAQ System
- Data Repository

The user is expected to enter the input through the application and then it will be processed by the discussed components in a systematic manner [15],[19],[20].

NLU Processor

For the purpose of translation of one language to another so that human understandable language is translated in a way so that machines can work further upon it, Natural Language is used. It is a component of Artificial Intelligence which enables computers to recognize language read and written by humans [6], [15], [20]. The NLU process interprets the user input so that it can be processed further efficiently. The Intent classifier identifies the intent of the user and then responds according to it on the basis of already available intents supported by the AI bot. It responds according to the intent recognized and supported by the chatbot and for this purpose it uses machine learning algorithms [21], [22]. Entity Extractor extracts crucial information from the user inputs and then responds according to it.

Dialogue Management

It is the job of dialogue management to manage the conversation. It uses machine learning and conversational history for the most effective conversation. It ensures that the valuable information from the user is taken in the form of input and its actual context is managed. Response Generator on the basis of intent identified and the input entered by the user generates responses. System Info considers its previous conversations from the past and acts accordingly if any relatability is found.

FAQ System

FAQ is responsible for responding to user’s queries on the bases of information available in the system knowledge base which is feed by domain expert.[7] Existing knowledge system looks for previous experiences. Manual Training components work in accordance with the data provided by the domain expert on specific topics and knowledge provided by him/her. The bot takes into consideration the already existing list of questions and answers which enables it to respond quickly to user queries. Automated Training is based on the already available documents to the bot so that in case of predefined questions it can answer to the queries itself. The documents include policy documents and other Question Answer documents. [8] API (Application Program Interface) work as an interface between the applications and provides them with the functionality to request data from other applications. API Calls are used for delivering the data after natural language processing and dialogue management to further applications. For an AI call to work, an application requests data from it which it retrieves from other application.

ETL (Extract, Transform, Load) Data is utilized for extracting, transferring and loading data from the source to the application for processing. It integrates data from the source and loads it into the target system. [9]

Data Repository stores structured and unstructured data so that it can be extracted and utilized efficiently by the chatbot application. It acts as a data archive or a library with isolated data sets which can be used for varied purposes.

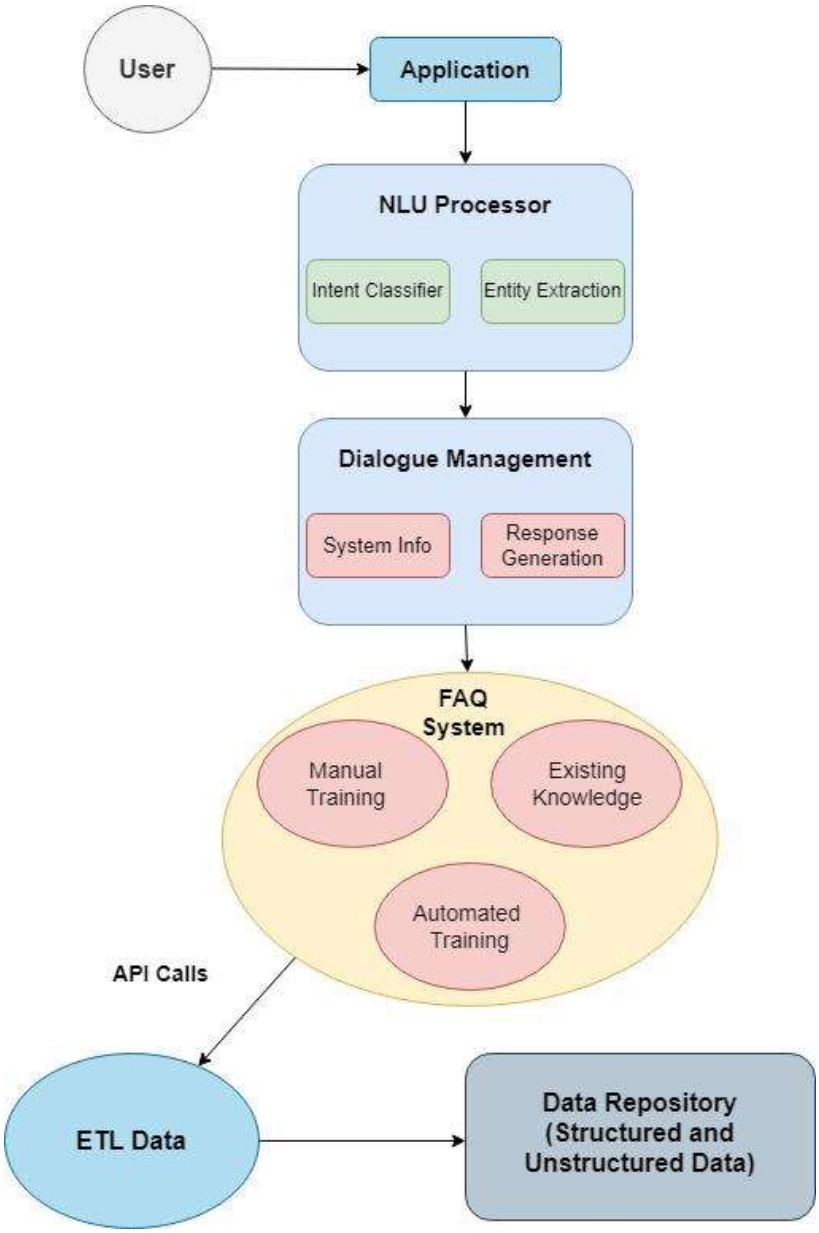

Figure 2: Architecture of Conversational Chatbot

IV. CONCLUSION

The proposed chatbot works with an objective to extend medical resources and verified information related to COVID19 to all sections of society for better health management. Even after the pandemic gets over, the chatbot can contribute to support medical needs by providing verified information, suggestions, symptoms, medications and other related resources for other contagious diseases. The proposed architecture embedded with various components namely NLU Processor, Dialogue Management, FAQ system and Data Repository which perform assigned tasks required for a conversational chatbot to be used for COVID 19 support. The components perform the tasks in a systematic manner for the whole process to run smoothly. The discussed AI Chatbot aims to perform a meaningful and efficient conversation with the user with the purpose of providing the user with required medical resources in the form of verified information [10].

V. FUTURE SCOPE

The architecture proposed is not only useful during the period of COVID pandemic but also aims to handle it's aftereffects by providing its support related to COVID and other infectious diseases. In future, we plan to enhance the architecture by integrating the conversational nature of chatbot with other trending technologies which include voice bots and human touch. It will also include a feature which will verify

the information related to C OVID and other infectious diseases as required by the user. The enhanced architecture will look forward to working as an extended hand of medical professionals in providing the users the desired medical help.

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