Dynamic NLP Enabled Chatbot for Rural Health Care in India

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Abstract: **Medical practitioners can use telemedicine to connect with their patients during the recent Coronavirus outbreak, while also attempting to prevent COVID-19 transmission among patients and clinicians. In the middle of the pandemic, Telemedicine can help patients by allowing them to obtain supportive care without having to visit a hospital via a conversational AI-based application. As a result, telehealth will transform in-person care into remote patient connection fast and drastically. In this paper, Natural Language Processing (NLP)- based Multilingual Conversational Bot has been developed to provide chronic patients with free fundamental healthcare education, information, and guidance. Countries like India, rural health-care management is challenging task with available medical experts and equipment's. So proposed Tele-health care management leads towards healthy rural people and their development. Existing Application Programming Interface (API) like Dialogflow can be used along with our health-care mobile application to provide live treatment and diagnosis.**

Keywords: Chatbot, Medchat, Health-Care, NLP, COVID-19.

I. INTRODUCTION

Artificial Intelligence (AI) driven chatbots are exemplifying the function of a virtual assistant that can manage a discussion via speech or textual techniques in the current expanding age of digitalization. With continued use, they adapt to the user's specific language usages, searches, and preferences. To be beneficial in the realm of healthcare, voice technologies must be adapted.
It turns the user's speech to text using artificial intelligence, which is then processed and interpreted using natural language processing. The integration of chatbots into telemedicine is discussed in this research. [1][2].

1.1 Aim of the Medchat

The main aim of this paper is to design the Medical chatbot (Medchat) for remote consultation for COVID-19 patients. To explore the transformation in-person care to remote consultation using Medchat with Natural Language Processing (NLP). To assess how well-received Medchat is in providing free primary healthcare education, information, and guidance to chronic patients.

1.2 Scope of the Medchat

Necessity of this kind of medchat applications are released in pandemic situations. Virtual assistants with artificial intelligence that can provide treatment to a wide range of patients 24/7. It can be used by doctors to communicate with their patients during the recent Coronavirus outbreak, as well as to try to prevent COVID-19 transmission among patients and professionals.

1.3 Methodology

The integration of chatbots into telemedicine is discussed in this research. The "Aapka Chikitsak" AI solution offered by Urmil Bharti et al incorporates a Natural Language Processing (NLP) enabled Multilingual Voice supported mobile Application to deliver emergency, essential healthcare education and counselling to chronic patients for their routine diagnosis and

rural women in need of antenatal care. It translates the native peoples local language to text, which is then analysed and interpreted using NLP API like Dialogflow, resulting in steps to recover and medication procedure that is then converted back to local language in the form of speech and returned to the rural people. Our paper addresses the most common ailments in rural and remote places in India, with a focus on women's health. By providing awareness about preventive measures, healthcare tips, home remedy or cures, symptoms addressing steps, and location-based food suggestion and its importance, our app provides the services of a doctor. Because prevention is always preferable to cure, having a personal healthcare assistant will be incredibly advantageous, and our software will provide an effective and immediate answer to those in need[1].

II. LITERATURE REVIEW

Urmil Bharti et al. presented an NLP-based multilingual discussion chatbot called "Aapka Chikitsak" using Google Cloud Platform (GCP). Artificial intelligence (AI) is being utilised to close the gap between demand and supply for human healthcare professionals.[1] Healthcare provided from afar. B.M.C. Silva and colleagues provide a detailed overview of the state of the art in Mobile Health(m-Health) services and applications.[2] It examines the top and most innovative m-Health services and applications presented by industry. AmonRapp, et. al conducted review for 83 articles about text based chatbots. emotions and humanness in interaction with chatbots considered[3].
Andrew Reyner et al.review report focuses mainly for countries with less doctor resource than patient. 24x7 support but service provided by doctor on other end. Studies various text and tele - health applications and its challenges.[4] In Arfan Ahmed et al. To discover existing chatbot apps for anxiety and depression, researchers used a systematic review and meta-analysis (PRISMA) approach. Examine the quality and features of anxiety and depression chatbots accessible for Android and iOS. [5].

G Silva and colleagues, Three phases of methodological research were carried out. BOTCURATIVO is a chatbot that assists non-specialists with wound dressing. The content validity of the script generated and put into the chatbot prototype was satisfactory [6]. Sooah Jang and her colleagues Natural Dialog Systems, or chatbots, are the subject of this literature study, which covers their history, technology, and applications [7][8]. This report examines the future of technology in order for chatbots to become truly intelligent. The work of Prakhar S et al. focuses on Snippets were used to create the pattern. a diagnosis bot that converses with patients about their medical concerns and questions with a standard precision of 65 percent, our chatbot system is qualified to diagnose symptoms from user inputs [9].

P Kandpal et al. worked on neural networks, which were utilised to train data and provide numerous packages that aid in the production of improved outcomes. We will combine Natural Language Processing and Deep Learning ideas in this chatbot to achieve better results[10]. A There are 41 different chatbots that can be utilised for mental health, according to Alrasaq et al. [11] investigations. The study of chatbots in mental health is still in its early stages. There are a variety of chatbots that are used to treat a variety of mental illnesses and purposes.

Data transferred from the iPad to the chatbot server (Glitch) was encrypted in transit and at rest, according to Chetlen et al [12]. Patients can learn about the next phase of their breast care therapy, management, or procedure in an anonymous, private, low-cost, and non-time-limited way. J Beaudry et al.[13] developed an innovative approach to increase team involvement through a co-creative design process. According to qualitative feedback from research participants, our chatbot should be expanded and has the potential to assist youngsters. H Cuaya'huitlet and his colleagues suggested a new ensemble-based approach for value-based DRL chatbots. (1) Near-human-like discussion policies can be induced, (2) generalisation to unknown data is a challenging task [14]. The majority of chatbots follow the E.Kasthuri et al. IF THIS THEN THAT paradigm. This chatbot was created using natural language

processing and deep learning technology. They're simple to use, appropriate for people of all ages, and provide the most thorough answers to inquiries. E-learning is used to deliver the majority of today's education[15].

III. CONVENTIONAL HEALTHCARE SYSTEM

Every year, the United States spends 3.3 trillion on healthcare. This is higher than any other developed country on the planet. The majority of this money goes to traditional medical treatments, such as regular visits to a healthcare institution to maintain a chronic disease or an urgent condition visit for someone who gets sick or hurt [17]. Telehealth has the potential to reduce urgent care and emergency department visits while also allowing medical practitioners to communicate with patients outside of normal business hours. A significant component of telemedicine is the ability to interact with patients in a way that saves time and money while also allowing for a more open and accessible two-way communication [19].

Furthermore, frequent visits to a medical centre are expensive, particularly in rural locations. Telehealth apps and technology, like as video mode of interaction, may use to cut healthcare costs by avoiding unnecessary initial check-up visits. Telehealth is an economical and a better replacement to the emergency care for people who have a minor sprain, cold symptoms, or other than any emergency treatments. Patient visits to the Emergency Room(ER) can cost more than 400% than telemedicine consultations cost around using paid mobile tele-health Apps.

Panic attacks are responsible for a substantial percentage of "ER visits for non-cardiac chest discomfort." In any given year, 25% of adults in the United States are diagnosed with mental health issues (like panic disorder). Behavioral health specialists are now assisting these folks by providing them with treatment, thereby avoiding a trip to the emergency room. Telemedicine psychiatry may even be preferred by certain people over traditional therapy. Patients kept telepsychiatry appointments substantially better than traditional visits, with 92 percent of telepsychiatry appointments being kept, compared to 87 percent of traditional appointments[16].

Advantages:

- Patient satisfaction when they visit doctor's place and get treated by their medical devices.

- Psychologically patient feels better by getting physical contact.

Disadvantages:

- To avoid doctor visit for regular check-up, particularly in pandemicsituations.

- The inability to examine patients in a urgent schedule has risks.

IV. MEDCHAT: CONVERSATIONAL AI ENABLED CHATBOT

The dissemination of health-care related services via online media by using internet facility and Telecommunication technology is known as tele-health [11]. It allows professionals to provide care, guidance, notifications, awareness, symptoms analysis, and remote care to long-distance patients. A chatbot is a conversational agent that uses local language to connect with native users. Although some programmes act as trending virtual health-care advisors, none of them give basic steps to diagnosis and related information, preventive steps to avoid diseases, home itself remedies, or consulting for the Indian context with multilingual assistance. Because India has a diverse population speaking a variety of languages, access to healthcare is now hampered by a number of factors, including language hurdles, a scarcity of healthcare experts, a lack of medical infrastructure in rural, hill stations and tribal remote areas, and the expenses of medical treatment and consultation. As a result, an updated application needed with AI model to provide users with healthcare and public safety consultation, counselling to needed peoples, and information in multiple languages (English(UK), English(US), Hindi, Tamil, Telugu, Kannada, Malayalam, Gujarati, Assamese, Odia, Bengali, Marathi) in order to achieve better healthcare and well-being of India's large population and to helped us by providing healthcare cyber window after the pandemic lockdown. Along with this our proposed model connected with nearby pharmacy stock, which helps rural people to avoid unnecessary travel to town. Google maps API has been included in proposed app which gives nearby

pharmacies location also. So, Conversational treatment as well as guidance to purchase required medicines can complete full-fledged treatment like real doctor by using this application.

4.1 Tele-Health Agent for Conversational care

Conversational Tele-health provides assistance in the form of NLP enabled dynamic chat or voice discussion between the user and the machine. Tele-Health has the potential to personalise health services to users' requirements in order to enhance their health by providing patients with valuable guidance and treatments from the comfort of their own homes. The use of Human interaction with Machine in the healthcare arena is critical for finalizing the solution and aggregating a doctor's services. There are numerous overcoming the obstacles of accessibility, practicality, and may lead mis-communication for patients. By utilising telemedicine, our model enables the solution to mis-communication and gap between patients and doctors during pandemics[18].

Fig. 1 depicts the entire working model of Proposed tele-health mobile applications. This AI-powered multi-lingual conversational bot is built on a serverless autonomous architecture. By using Natural Language Processing (NLP) with advanced tools from universally accepted standard, we can get user input in varieties of language and Natural Language Understanding (NLU) are built in to interpret to make mobile application to understand the user's query and respond appropriately. NLP makes it easier to read, interpret, comprehend, and understand human languages. Our architecture's first level of processing is dedicated to audio processed Input and Output. When a user submits a query, the inquiry is transformed from audio to text, a process known as Speech-to-Text [15].

The extracted form sequences of characters / text is used as a foundation for making system to understand for further actions. In order to decode into the useful format and get the semantic meaning of the user input and recognise morphemes at the second level of processing. Because there is no requirement for audio-to-text conversion in a chat interface, this is considered the initial level of processing. The entities are

recognised based on the semantic meaning of the user speech, and then mapped to the relevant intent on Dialogflow [13].
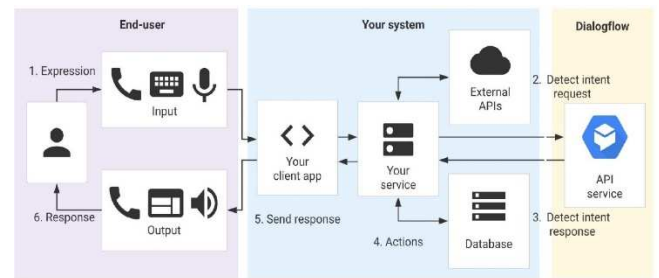

Figure 1. Architecture of Medical chatbot Application

4.2 Technology Stack – Telehealth Mobile App

Our Dialogflow agent does the intent mapping, which has been already effectively trained on pre-defined and quality training words to decide it to make conclusions. After the scope matching is complete, Dialogflow sends an Hyper Text Transfer protocol (HTTP), POST request to the Webhook instead of GET for fulfilment in order to respond to the user. Cloud functions for firebase [14] are utilised to generate a Webhook for our bot. The details about the matched intent, the necessary action, attributes required, and defined response for that particular reason are all included in the webhook request. The request from webhook is fulfilled by the Google Cloud Platform cloud function, which then delivers a webhook response message to Dialogflow. The response message constructed with generated response that planned be given to the user at the end of the process. The text response is also transformed to speech (Text to Speech) and returned to the user in the case of a voice interface. Fig. 2 depicts the technology stack employed by our bot.

A.   Online-Health Bots with Voice-feature
The speech bot's interaction procedure is meant to make communicating with the user as simple as possible. Voice is the psychologically closed medium for communication, as well as the most natural. Voice bots use a Natural User Interface (NUI) and are AI-powered, allowing them to understand and have human-like conversations.
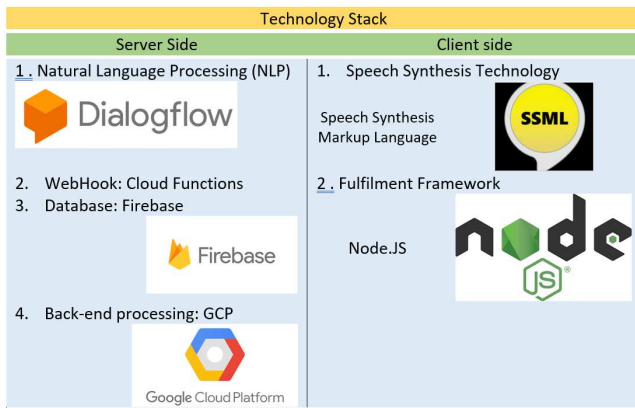
Figure 2. Technology Stack used for AI-Enabled mobile chatBot

B. Voice User Interface (VUI) model

A standard voice-user interface (VUI) allows humans to converse with computers by using speech recognizing model to recognize input spoken words and respond to asked questions, as well as conversion process from text to speech to construct a response. To enhance the voice experience and make it to more practical and consistent, the Speech Synthesis Markup Language (SSML) [14] is employed. When creating the voice user interface for our conversational system, we keep a few things in mind. Our proposed medi-bot has a feature that makes it sound realistic human interaction, credible, and approachable.

4.3 Sequence of Operation in Medchat Application

1. The user expresses himself or herself via typing or speaking.
2. In a detect intent request message, your service delivers this end-user expression to Dialogflow.
3. Dialogflow majorly used to detect the purpose of the text and its intent to make more matching response message. The matched output intent, the process, required attributes, and the response defined for the intent are all contained in this message.
4. Your service executes operations as needed, such as database searches or requests to external APIs.
5. The end-user receives a response from your service.
6. The reaction is visible or audible to the end-user.

4.4 Real Time Applications

Multilingual Conversational: Considering the aftereffects of a pandemic as well as the disparity between demand and currently available healthcare services, particularly in rural India, researchers have attempted to close the gap by developing a Multilingual Conversational Application with Natural Language Processing (NLP).

Personalized healthcare: This is a personalised healthcare bot that is sensitive to the needs and understanding of the Indian rural population. It provides generic healthcare information as well as preventive measures for common diseases and ailments native to our country in a user-friendly manner, with a focus on interactive antenatal and postpartum healthcare.

Table 1. Comparison between Conventional and Proposed Telehealth App

Conventional Tele-health App	AI-Enabled Telehealth App
Pre-programmed suggestions	Automated personal consultation
Common medicine or treatment	Region or Geolocation based treatment
English, Hindi language support	Multilingual treatment
Medicine suggestion without consideration of availability in local pharmacies	Geo-location of pharmacy with medicine availability suggested
Native language voice-based treatment not-available	Native language voice enabled app

Table 1 illustrates the importance of proposed mobile application over conventional tele health application. Also the proposed model helps for Home cures, location-based nutrition suggestions, age and gender-specific health check-up guidance, emergency hotline numbers, and it can be integrated with a real-time messaging app like WhatsApp are among the extra capabilities. The goal of this programme is to help the general population attain overall wellness not just prevent nasty infectious diseases.

V. CONCLUSION AND FUTURE ENHANCEMENTS

Overall, proposed NLP based chatbot for medical applications assures the importance of medchat in current pandemic situations for both patients and doctors. NLP, Deep learning and AI techniques are mostly supported for automated medchat for diagnosing patients in 24x7. Geographical barriers can be solved by using this type of NLP based chatbot in this pandemic situation. Well trained NLP and AI based implementation can utilize recent datasets to increase the accuracy of diagnosis. Client-side AI devices can be used to scan and check oxygen level. Those data can be accessed by doctor in his/her interface to provide suitable treatment.

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