AI-Driven Healthcare Systems: Harnessing the Power of NLP

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Abstract— **This paper provides an evaluation and comparison of existing studies relevant to various systems functioning as virtual medical assistants and their associated methodologies. While the literature encompasses numerous research contributions, we have conducted a thorough and detailed review of recent studies and survey papers pertinent to AI-based healthcare systems. The current approaches are categorized based on the foundational concepts underlying their mechanisms. Emphasis is placed on the concepts employed by the respective authors, the experimental methodologies utilized, and the parameters for performance assessment. The researchers' claims are also outlined. Our findings from this comprehensive review highlight identified challenges.**

This paper serves as a crucial resource for the comparative analysis of diverse healthcare system approaches, which is essential for addressing remote health challenges. Finally, we propose our solution related to the healthcare domain, integrating AI with NLP and ML. Our implementation enables straightforward and immediate diagnosis of diseases or conditions, with details provided remotely before consulting a healthcare professional or visiting a doctor. This approach inherently reduces healthcare costs while offering easy accessibility anytime and anywhere. Moreover, our proposed solution appears reliable and precise.

I. INTRODUCTION

All industries are developing and incorporating the newest trends. A that aids in recognising client issues and remote troubleshooting are two of the approaches currently being used. In the end, this lowers communication barriers and enhances the client experience [1]. A is a piece of intelligent software that can interact with users in a way that is similar to how a human might. The s are used for customer service, social media marketing, and instant messaging on a variety of platforms and websites. Artificial intelligence and Natural Language Programming have long been an element of technology. have programmes that analyse and recognise spoken speech [2].

The medical industry is no different. Healthcare systems are one of the many areas in which s may be employed. An interactive medical engages the user in a one-on-one discussion and questionnaire about their health issues. NLP and AI are used by these s [3]. The system is given all the data about illnesses and their symptoms, and with the aid of NLP, it will be able to comprehend the user inquiry and produce the appropriate response. It is necessary to either construct or supply a database with all the information on medical conditions and disorders. Data from a medical database are retrieved by the [4]. By posing numerous questions, the mimics the interaction between a doctor and patient. These inquiries are based on the patient's prior information and pre-filled conditions, and a potential diagnosis is formed based on the answers [5]. These bots interact with potential patients who are browsing the website, assisting them in finding experts, scheduling appointments, and gaining access to the proper care. The nicest part about a healthcare is that these types of s can be accessible from anywhere, even in the most distant place, and they offer patients 24/7 online healthcare help. It aids in the generation of health data and instantly transmits report information to medical management [6].

The overview of the current methodologies is the primary topic of this study. Though there are many review articles on

healthcare systems that have been published in the literature, we have critically analysed and systematically summarised the most current, significant papers. Additionally, this research offers a potential remedy for healthcare systems. The structure of this essay is as follows. The systematic presentation of the literature review is done in Section 2, which includes a synopsis of the relevant work as well as the main points of the connected methods. The reason for the formulation of the problem and the discovered problem is provided in Section 3. The operation of the suggested technique is thoroughly explained in Section 4. The conclusion is contained in Section 5.

II. SURVEY OF EXISTING APPROACHES

The available literature that is pertinent to healthcare systems and the mechanics underlying them is critically analysed in this section. Although there are many research contributions in the literature, we have only examined the most recent, significant, and useful study and review publications here. Based on the fundamental ideas used in the mechanisms, the existing techniques are divided into several categories. The authors' concepts, the platform they employed for their experiments, and the effectiveness of their systems are all highlighted. Additionally, their claims are emphasised. Finally, a summary of the conclusions relating to the research articles that were read and examined is provided. The section's conclusion includes the cause of the detected problem.

Bushra Kidwai and Nadesh RK created a diagnostic in 2020 utilising the most recent machine learning methods. A decision tree technique is applied for symptom mapping and diagnosis [1]. The system is given all the data about illnesses and their symptoms, and with the aid of NLP, it will be able to comprehend the user inquiry and produce the appropriate response. The information is retrieved from a medical database that contains information on 150 disorders. By posing numerous questions, the mimics the interaction between a doctor and patient. These inquiries are based on the patient's prior information and pre-filled conditions, and a potential diagnosis is formed depending on the patient's responses. The system can be interactive, according to the creators. Round-Trip Time is the performance assessment parameter that is employed.

A healthcare that uses NLP was proposed by Papiya Mahajan et al. for 2020. The system may offer voice or text support [2]. According on user symptoms, the created is said to deliver ailment details. The N-gram algorithm, TF-IDF algorithm, and Cosine similarity algorithm are the three algorithms employed in this technique to create a health care system. The system also gives information on the doctor. People will therefore be aware of their health and be properly protected. The authors assert that their offers individualised diagnoses based on symptoms. However, no performance evaluation metric is offered to support the assertion.

Harsh Mendapara and colleagues created a healthcare system based on AI and NLP in 2021. Before seeing a doctor, a person may use the to self-diagnose their sickness and learn more about their particular disease [3]. The authors utilised chatterbot library to train a using AI. Additionally, they have taught the to recognise particular words and phrases so that the user's purpose may be understood. The system is then provided the information that has been gathered. Personal information provided by the user will be kept in the database. The will use NLP to enquire about symptoms. It will list potential diseases and make medication recommendations for those with known illnesses. A clinic appointment can also be made via the system. The resulting findings, according to the authors, are precise and quick.

Mr. Niraj A. Wanjari and colleagues created a based on AI and NLP in 2022. The authors assert that their improves accessibility and lowers total healthcare costs[4]. The illness is identified by text-to-text communication between the system and the patients. Additionally, the right course of action is advised. We discovered that the bot architecture is in its infancy and is not fully formed. The paper is more of an assertion than a practical application. To support the authors' assertions, no performance assessment criteria is offered. However, this project has a lot of room for expansion. It is possible to create a mobile assistant that many people can utilise. This can be exact and will eventually somewhat shorten the time.

M.V. Patil, et al. created an AI-based healthcare conversation bot system in 2021[5]. The suggested medical deals with giving medical advise while making decisions in accordance with the patient's request and using dialogues to draw analogies. For this, a database is constructed. If a certain piece of information isn't in the database, a search engine will be used to find it and present it to the user. Three separate outputs from experiments are utilised to demonstrate how well the suggested system recognises illnesses and other common symptoms. To support the authors' assertions, no performance assessment criteria is offered, though.

Before contacting a doctor, Lekha Athota et al. created a in 2020 that can identify the illness and offer details[6]. N- gram, TFIDF, and cosine similarity are used in the ranking and text similarity computation performance assessment parameters. The information is kept in a database, and the queries are handled by a third party. The keywords are given so that the right response to the query may be found. Users also have access to a web interface. The authors assert that by protecting user privacy, character integrity, and accessing pertinent information in response to queries, their application has been improved in terms of security and efficacy. To support the authors' assertions, no performance assessment criteria is offered, though.

III. MOTIVATION

Using artificial intelligence s, it is now feasible to have natural language conversations with robots. We learned from the literature that s often perform the same duties as a standard search engine. The essential process flow remains the same even if the

only provided one output rather than several outputs or results—each time an input is entered, a fresh search is conducted. Nothing to do with the earlier output. The goal of this study is to develop s into search engines that can process subsequent searches in relation to the results of prior searches.

IV. PROPOSED APPROACH

In the last several years, artificial intelligence (AI) has advanced significantly, and it now has branches in every industry. As a crucial component of AI, machine learning is beneficial for taking into account incoming data, looking for relevant patterns, improving upon itself, and displaying the results. In the modern computerised world, where health is frequently disregarded, adopting a healthy lifestyle becomes a top responsibility. It might be quite challenging to locate a competent health expert in distant places who can effectively address the health concerns. Making a healthcare based on artificial intelligence is one possible solution to this issue. Additionally, we can combine AI with machine learning, natural language processing, and NLP (ML).
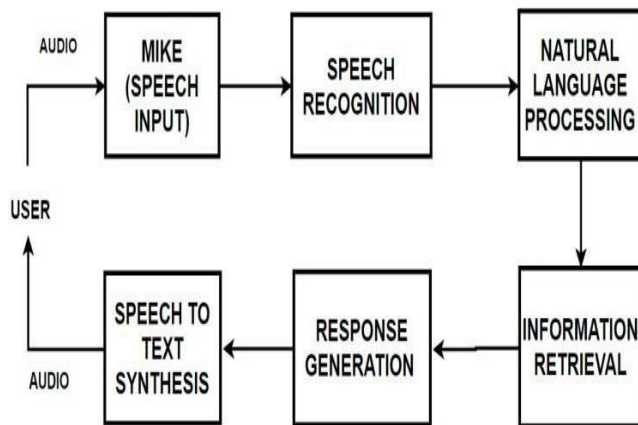

Fig. 1: System Architechure

Before seeing a medical professional or seeing a doctor, the idea is that one may quickly and simply identify the sickness or illness and supply the data remotely. This may be conveniently accessed at any time and location and has the inherent ability to lower healthcare costs.

With the aid of Fig. 1, the suggested approach's entire operation may be visualised. This method begins by requesting audio and text input from the user using an Android app. The entered text is handled. In the event that the input takes the form of voice, speech recognition is used. The voice is processed using natural language processing (NLP), and information and other keywords are then extracted. The response is generated either in the form of text or speech.
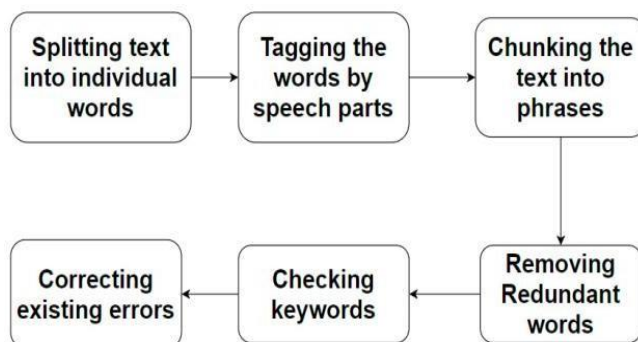

Fig. 2: Pre-processing of text input

Pre-processing of the voice input is necessary, and this process is illustrated in Fig. 2. Here, the speech is recognised, the text is broken up into words, and the recognised words are labelled with the speech components. The material is broken up into correct sentences and phrases. The extraneous words have been omitted. If any of the discovered keywords are incorrect, the keywords are reviewed and corrected.

The user is now requested to respond to the 's query. A value is created once the entered value has been carefully examined in the edit text. The user interface receives the value after that. When a query is entered, the server responds with a JSON response. We must parse the server response in order to obtain the bots' answer. The procedure of conversing with the is continually repeated.

In order to implement the suggested strategy, we created a system that includes a web application. First, we developed a that may help patients learn about the signs and symptoms of their illnesses. Then, we'll add a link to the website of the relevant hospital to assist others in learning about medical reports. The system's database is used to store user information.
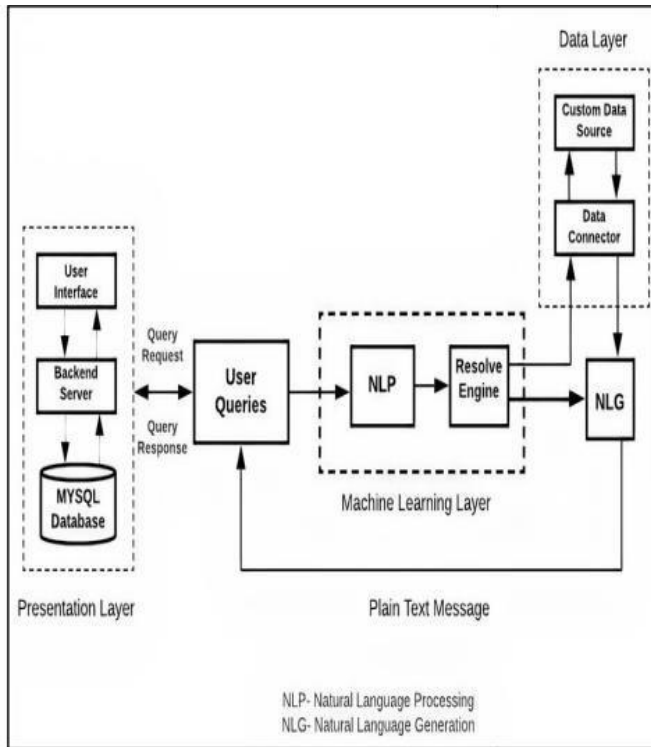

Fig. 3: Proposed System Architecture of AI Based Healthcare System Using NLP

The suggested device can be accessed by utilising the entities known as Admin and User. To use the healthcare online application, the administrator must first log in using their login credentials. Natural language processing is used to separate the user inquiries that take the form of text. The remedy engine makes it easier to select from the entered information and goes beyond to bespoke data sources. To examine the text's grammar and syntax, the output statistics are retrieved and sent to the NLG engine. The final message is transmitted to the localhost server and displayed inside the healthcare 's user interface.
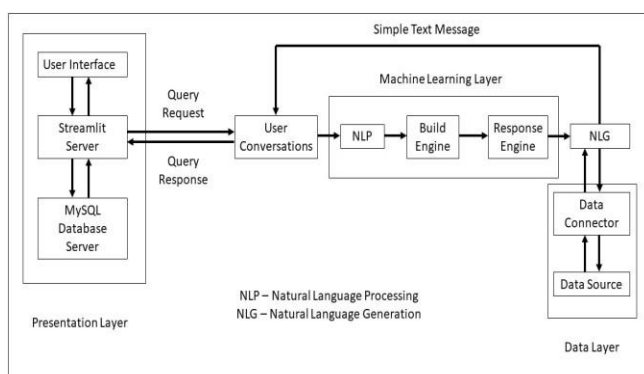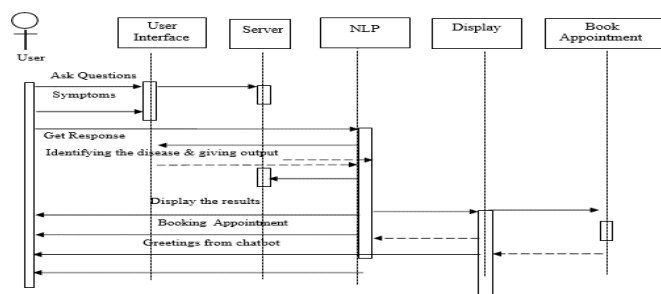

Fig. 4: Architecture of Proposed System

Fig. 5: Sequence Diagram of AI Based Healthcare System by Using NLP

The fundamental element of the recommended approach to system development is web apps. First, a is created that may help consumers learn about their medical issues. Then, to help people learn about medical reports, we'll include a link to the website of the appropriate hospital. Users' data is kept in the system's database. We utilised the chatterbotlibrary to train a to recognise specific phrase categories and comprehend user intent. The information will then be obtained by the backend. The may be trained to answer and reason rationally in certain circumstances without contacting the backend. Medical applications are part of the proposed system development methodology. It goes into detail on the system's commercial aspects. First, a is created that may help consumers learn about their medical issues. The hospital website is then included, assisting visitors in knowing more about the establishment and its staff. Users' data is kept in the system's database.

Only the sequential order of object interactions, or the order in which these interactions take place, is shown in a sequence diagram. When utilised properly, the terms event scenarios or event diagrams may also be used to describe a sequence diagram. This approach is commonly used by business owners and software developers to develop and understand requirements for new and current projects. The user must give personal data, such as name, phone number, age, and date of birth. A will ask the user to explain their symptoms and respond with the disease and possible therapies using natural language processing. It will then ask you to make a hospital appointment after that. The health care bot will then provide the user their appointment details and end the chat, allowing them to exit the portal.
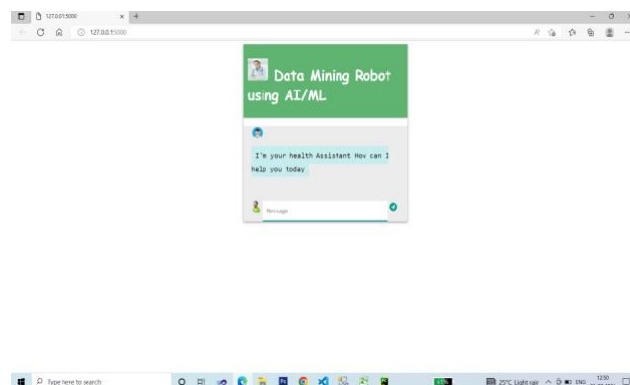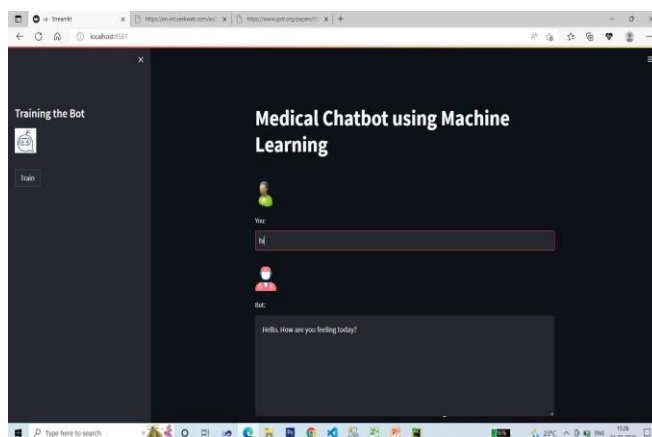

Fig. 6: Home page of AI Based Healthcare System

Fig. 7: AI Based Healthcare System

V. Conclusion

We have analysed and contrasted the available literature that is pertinent to various s in this essay. These s serve as virtual healthcare providers. The present techniques are systematically grouped based on the fundamental ideas employed in their procedures. Following a review of the literature, we have suggested our approach, which addresses the problems. The comparative analysis of various healthcare techniques, which is a requirement for resolving distant health concerns, would be greatly aided by this work. We merged machine learning, NLP, and AI. One may quickly and easily identify the illness or disease, and the information may be supplied remotely, before calling a medical expert or going to a doctor. This has the inherent capacity to reduce healthcare expenditures and is readily accessible at any time and place. Furthermore, our advised course of action is accurate and consistent.

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