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Design and Implementation of a Machine Learning Based Disease Prediction Chabot Using User Symptoms

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Abstract— *In recent times, healthcare is becoming more accessible to a wider group of people through the medium of technology. In today's busy world, many people forget to take care of their health, which can lead to serious issues. You can prevent this problem by using an app that predicts diseases based on symptoms. Our project aims to give users quick and accurate predictions of diseases based on their symptoms, along with a clear explanation of their pathology reports. The disease prediction chatbot uses natural language processing and machine learning techniques. This paper proposes a plan for a chatbot that uses machine learning. It combines natural language processing, machine learning techniques, and statistical analysis. gaining knowledge of the technologies in a Spark cluster to help create an intelligent chatbot. In this work, we conducted a thorough analysis of current literature, looking at a large number of chatbot-related papers over the last five-six years. Next, we introduced many related tasks to our chatbot, which uses user symptoms to anticipate illnesses. Overall, the study highlights the potential of AI-based chatbots to revolutionize access to healthcare and self-diagnosis, thereby bridging the gap between users and treatment.*

Keywords— Disease Prediction, Machine Learning Artificial intelligence, chatbot, natural language processing, conversational agents,RNN model, geocoder, LSTM.

I. INTRODUCTION

In contemporary world, healthcare services are needed. Alongside the internet addiction, people today are very engaged in their work. Their healthcare doesn't matter to them. So, the hospital stays clear. Therefore, we propose the use of the Python programming language, natural language processing techniques, and machine learning algorithms to build a healthcare chatbot system. They help us diagnose diseases, provide us with very specific information regarding the disease before we visit the doctor and suggest local hospitals based on their locations. Patients [1] benefit from healthier and better knowledge regarding the disease. All the relevant information related to an illness stays accessible to users. To answer the customer inquiry, the scheme application uses a question and answer system similar to that used in a chatbot system. Answers to the inquiry are supported by the answer to the To answer the inquiry sets, the system obtains important terms from the inquiry sets. It recognizes your type of disease, authenticates the user inquiry regarding the disease, and also identifies some diseases if there's a match found, an important answer delivered, or a similar answer observed. [2] Provide the doctor with the specifics. This systems application can be compromised as a strategy to

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reduce healthcare issues. The goal of this process is to save the user time and the inquiry cost. This is mainly since the consumers cannot physically visit a doctor/consultant right after they need the consultant. Nonetheless, to build a healthcare chatbot system that would provide round-the-clock medical assistance, help, and guidance on the disease and its symptoms, we have applied machine learning techniques, Python programming, natural language processing techniques, and AI.

Devices, especially computer systems that mimic human intelligence tasks, can be called artificial intelligence [3]. These processes include self-adjustments or self-correction, understanding (learning how to use information), and reasoning (using rules concerning possible or definitive assumptions). Chatting robots can solely be one way that artificial intelligence can be applied in the future because it has currently reached its peak. The primary aim of the computer program is to eliminate the language barrier issue between patients and health practitioners by providing appropriate answers to consumer inquiries about experts. [4] Currently, people are more likely to be cyber junkies without even taking heed of their health conditions. We won't be taking visits to the hospital for what appears to be a mild disease that could end up being a severe one. Instead of browsing through the online collection of what could be applicable information on health issues, it is convenient to devise answer-and-question sites that can help answer these issues. For starters, there could be some issues relating to some health programs currently being used; for patients that lengthily wait for professional attention, there appears to be no remedy.

In countries such as India [5], where quality care and treatment are often not accessible, the emergence of healthcare chatbots becomes highly relevant. People often defer treatment and resort to substandard care due to the inaccessibility of healthcare facilities and lack of transport. This issue gets resolved with the introduction of healthcare chatbots, proving to be a huge relief as it provides instant care, accessibility, and assurance of the right treatment for the patients.

The research outlined in this [6] article seeks to develop an AI-powered chatbot system that places persistent care first while wounding expenses and increasing productivity. Chatbots are being used by healthcare companies to give faster care to patients by letting them answer questions through voice commands or written messages. The chatbots are being used to improve how well patients do, to reduce time spent at hospitals and clinics and to give patients quick answers to some of their questions. For example, if a patient is worried about something and asks a question of a chatbot, they can quickly be told possible causes, how to get an appointment and who they should see. The chatbot can answer questions about prescriptions, give reminders of when to take medication and help patients find a doctor who they can go to for help. The technology is new and is evolving. Healthcare chatbots will play a crucial role in modern healthcare because of new features and constant improvements that will boost their abilities and impact.

II. RELETED WORKS

In 2021, [7] Athulya N, Jeeshna K, S. J. Aadithyan, U. Sreelakshmi, and Hairunizha, also known as Nisha Rose, suggested creating a "Healthcare Chatbot." They develop a medical chatbot that can identify diseases and give basic information about them before you see a doctor. Using a medical chatbot will lower healthcare costs and give more people access to medical information. Chatbots are computer programs that talk to users in everyday language. In this system, the user can send messages to the chatbot through SMS, and the chatbot will respond with both voice and text. When a user talks to the chatbot, it will identify the illness based on the questions the user asks. The bot suggests experts who can help users with their problems and gives ideas on how to fix them. Several users can use this system at the same time without any delays. This project aims to quickly and accurately identify diseases based on their symptoms for consumers. A decision tree algorithm is used to predict diseases. Chatbots can greatly change the healthcare industry by offering predictions about diagnoses.

Gyant[8] is another chatbot that helps users with small, non-emergency medical problems. It does this by asking questions about their symptoms and overall health. A main feature of Gyant is that it uses humor, friendly chats, emojis, and memes to connect with users in a fun way. The software isn't available at the moment because it has been stopped. Symptomate is a chatbot powered by AI that assists patients by allowing them to describe their symptoms. It then provides them with a list of possible health problems they may have. Its accuracy is below 80% when compared to Ada Health. This means we need to enhance and create digital health solutions to ensure they are as effective and dependable as we can make them. Tanmay[9] and others. A study on the "E-Health Bot to Change Medicare" showed that

chatbots can greatly enhance and transform the delivery of healthcare services. For example, a medical chatbot with up-to-date information used AI to help address the increasing demand for easy access to healthcare help by quickly providing medical assistance and facts. Matthew[10] and his team developed a system where machine learning techniques were used to enhance the ability of the medical chatbots to predict health problems. Chatbots utilised symptoms and the patient's information in identifying the diseases early and suggesting the appropriate treatments. It resulted in better outcomes for the patients and smoother health care work. The study shows the AI powered medical chatbots have a huge scope for the development and prediction of illness and delivery of health care. The AI powered chatbot utilises AI technology and the machine learning algorithms to help solve the various health care problems and makes it easier to access the health care services, makes them work more efficiently and delivers more personalised diagnoses. Further studies are required to see how AI powered medical chatbots perform in a larger scale, how reliable they are and how effective they are in a real healthcare setting. The growth of AI and other digital health technologies such as chatbots will play an increasingly important role in public health. Research also has a crucial role to play in shaping the growth of digital technologies in public health. The focus of the study was on studying the impact of chatbots and other tools on health programs, learning from user experiences and keeping the user safe and healthy. The research involved studying how the tools such as chatbots affected the health programmes, learning from user experiences and focusing on keeping the user safe and healthy. To develop more effective health programmes, it is required to study the tools such as chatbots and their impact.We must also try to understand what Users feel or go through and how we can keep them safe and healthy. A study found that NLP and Machine learning can be very helpful in fixing many problems in Healthcare. Many people have used dialogflow and tensor flow to create their Chatbots, to see how well a Chatbot can do they used the best training method. We should try to make a better plan that can show how well a chatbot can do and how good it is at helping. If we can make a simple Question and Answer system we can have better communication.

Another point is that there is a large gap in the comparative study of different AI systems, as argued by [12]Disha et al. (2024). This gap needs to be addressed, To begin with, comparative performance across many more healthcare sectors is called for even as it sheds light on those disparities that exist between ML-driven symptom checks and triage bots. Indeed, it is a more challenging issue due to the absence of established procedures and standards for testing chatbot performance. And also, the area continues to suffer from a relatively low level of interest though they are highly significant in healthcare applications between the ethical implications such as data privacy, bias, and responsibility. For this general gap, the research community needs to fill this by concentrating on clinical validation, dataset variety, user-centric design, and ethical concerns to ensure relevant and successful implementations that would be widely accepted.

Table 1. Literature review

Sr. No	Title of the Article, Author, Journal Name, Year of publication	Design, Objectives, Method used and Sample size	Findings of the study	Remarks of the Scholar
1	Chatbot for health care and oncology applications using artificial intelligence and machine learning Xu, L., Sanders, L., Li, K., & Chow, J. C. JMIR Cancer, 2021	Systematic review of AI/ML applications in healthcare, specifically oncology. To explore the applications of AI-powered chatbots in oncology and healthcare. No dataset used as it is a review paper.	Identified that AI chatbots could be beneficial in oncology, but adoption barriers remain.	No primary data collection; based solely on literature review, so subject to publication

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3	Exploring the effects of interactive dialogue in improving user control for explainable online symptom checkers Sun, Y., & Sundar, S. S. CHI Conference on Human Factors in Computing Systems Extended Abstracts, 2022	Exploring how interactive dialogue can improve user control in symptom checkers. To examine the impact of interactive dialogue on enhancing user control and transparency in symptom checkers. Dataset not explicitly mentioned; focuses on the interaction between users and a system prototype.	Found that interactive dialogue improved user control and transparency, making symptom checkers more user-friendly.	Limitations due to reliance on experimental prototypes and small user sample size.
4	Supporting primary care through symptom checking artificial intelligence Mahlknecht, A., Engl, A., Piccoliori, G., & Wiedermann, C. J. BMC Primary Care, 2023	Primary care support using AI-based symptom checking in Italian general practice. To study the attitudes of patients and physicians towards AI symptom checkers in primary care. Dataset from a survey of physicians and patients from Italian general practice.	Found positive attitudes toward AI symptom checkers among physicians, though patient dependency is a concern.	Limitations due to self-reported data and possible response bias from survey participants.
5	A chatbot based question and answer system for the auxiliary diagnosis of chronic diseases Zhang, S., & Song, J. Scientific Reports, 2024	Auxiliary diagnosis for chronic diseases using a chatbot based on large language models. To design a system that assists in diagnosing chronic diseases with AI-powered chatbots. Chatbot-based question-and-answer system using large language models for auxiliary diagnosis.	Showed promising results for assisting chronic disease diagnosis but needs further improvements in accuracy.	Needs larger, more diverse datasets for better generalization in clinical environment

III. PROPOSED METHODOLOGY

Our project uses the chatbot to gather information. It collects the patient's information and their symptoms, then predicts the disease based on those symptoms. The disease prediction chatbot is created using ideas from natural language processing and machine learning techniques. The chatbot uses two main ideas from Natural Language Processing: tokenization and WordNet. When the user shares their symptoms, we break down the sentences to pull out the specific symptoms they mentioned. Synset is an easy-to-use tool found in NLTK (Natural Language Toolkit) that helps you find words in WordNet. Synset instances help find words that mean the same as the symptoms. Procedures for the suggested approach Several machine learning methods that are based on a multitude of datasets are used to process input data. To forecast illnesses based on user symptoms, recommend hospitals and medical facilities in the area depending on the user's location for better access to healthcare, and train and test on a large number of datasets for both known and unknown data. user input.

A. Dataset

The purpose of this JSON dataset is to teach a chatbot to identify and react to signs of dengue disease. It has categories for categorising diseases, typical symptom patterns, and pre-written answers with tips on how to prevent mosquito bites, remain hydrated, and check platelet counts. Using this information, the chatbot offers precise advice on how to prevent and manage illnesses.

Names, locations, and coordinates of medical centres are also included in the collection. Users' location will be recognized by knowing their IP address, then the Haversine formula will be applied to measure the distance and hence getting the nearest centers. The results will be sorted by how near each center is to show users the closest medical facilities for ease. Since the final model of the chatbot would be able to identify and respond to symptoms of Malaria using a JSON dataset provided for training purposes, the dataset includes labels to determine illness, typical symptom patterns and a predefined set of responses offering advice on Malaria recognition, handling and prevention including drinking enough water, consulting a doctor and the use of mosquito nets and insect sprays. The knowledge of

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the symptoms, how to handle them and prevent them was given in an understandable way to the chatbot using the dataset in the training step.

TABLE 2. INTENTS-BASED DATA

Tag	Patterns in User Conversation	Respones
greeti	"Hi", "Hey", How are you", "Is anyone there?", Hello", "Good day"	Hi there, what can I do for you?
Depression	“persistent sadness, loss of interest, fatigue, changes in sleep patterns, no sleep"	"responses": "You might be experiencing Depression. It's a mood isorder characterized by persistent feelings of ness and a loss of interest in activities "Precaution":"To id depression Depression

IV. RCHITECTURE OF CHATBOT

The design model outlines tools that assist users in identifying health issues and accessing medical information. The user begins by typing in a description of their symptoms. Then, the algorithm looks at this description and pulls out important information. After confirming that the symptoms are real, the information to an AI/ML model for more analysis. The model looks at potential diseases, gives a basic overview, and recommends ways to prevent them. The system will prompt the user to see if they want details about nearby hospitals. If the user agrees, we can find the closest healthcare facility by using their location and measuring the distance. If the user does not ask for more help or if the symptoms are not accurate, the process will end. This design helps make healthcare services work better and faster.

V-MACHINE LEARNING IN MEDICAL FIELD

Several apps have been developed using machine learning technology. One important way to use it is in the medical field. Machine learning is gaining popularity today because it is a new way to make the healthcare system better. One way to reduce healthcare costs is by using machine learning as a useful tool. Studies indicate that the healthcare field uses machine learning to identify diseases. This can mean reviewing patients' previous records to forecast future results by inputting some information, or it can involve using image processing to examine and analyze pictures to predict health outcomes. When used properly, machine learning assists doctors in making nearly flawless diagnoses. A key benefit of using machine learning to predict the results of a specific disease is that it can provide suggestions based on a person's health details, like their age and gender. This can help individuals become more aware of their health early on. This benefit is one of the reasons we face when working on the problem in this proposed project.

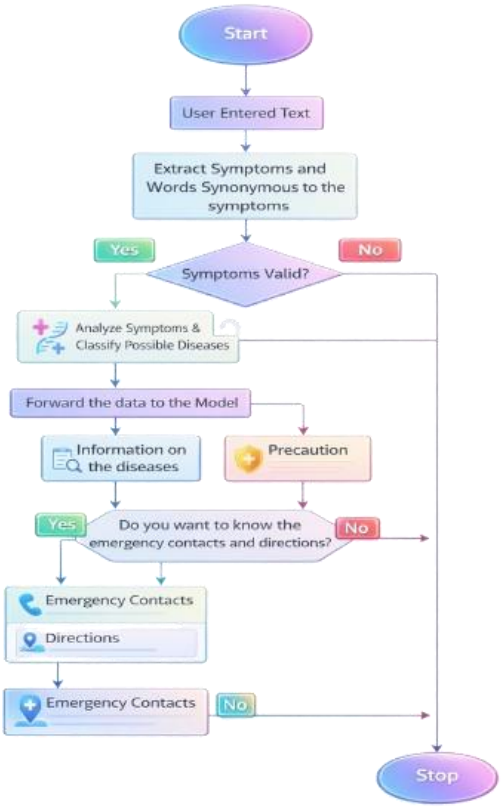

Fig.1 Flowchart of chatbot working

VI -CHATBOTS & NLP CONCEPTS

Short-term memory (LSTM) is a type of recurrent neural network (RNN) specialized for processing continuous objects (such as text or time data) and is used in the RNNModel class to create neural networks. This model is basically initialized with several parameters: num_layers sets the output_size of the LSTM operation, which corresponds to the desired size (for example, the number of layers in the distributed hidden_size function, which determines the size of the LSTM); setting the capacity of the hidden layer and model input_size, which indicates the number of

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features of the input data at a time. This arrangement allows the models to handle different inputs and varying levels of difficulty. This model has two main parts: an LSTM layer and another component. An LSTM (Long Short-Term Memory) is a type of network that continuously works and provides the hidden state at each moment. It has a layer that operates on its own. One of the layers connects the last hidden state of the LSTM, which gives the hidden state output we want, to the initial hidden state. Now, let's talk about the training process for the model. The first step is to prepare the data. This involves loading a JSON file that contains intents that have patterns and responses. We split each pattern into individual words, clean unnecessary punctuation and simplify the words to their basic forms. (For example, "running" becomes "run.") Each pattern has a bag-of-words representation, which changes sentences into numerical vectors that indicate if specific words are included or not.

We also convert the target tags (or intents) into integer labels at the same time. After this processing is complete, we change the inputs and outputs into NumPy arrays so PyTorch can use them. Before we start training, we choose a good device to use, like a GPU if we have one. This will help the model process faster. The training process uses the Adam optimizer, which is efficient and flexible in adjusting the training values, as well as the CrossEntropyLoss function, which works well for various types of classification tasks. The model then trains for a specific period of time with the provided information - about 1, 000 cycles. The optimizer updates the model's weights, finds gradients through backpropagation, and measures the loss for each group. The loss is displayed every 100 epochs to monitor how well things are improving. The model trained successfully and was saved, as shown by the success message on the screen. After training, this model can be used for tasks such as chatbot response or text classification. Additionally, RNNModel can sequentially learn patterns in data because text preparation techniques such as tokenization, stemming, and bag-of word interpretation ensure that the data input is in the correct format.Defined Rule-based: Simple machine learning approaches, a defined set of rules, and template-based matching are used to create existing chatbots.

1. Grammar Errors: It is impossible to identify grammatical errors.
2. Predefined or Closed-domain: prior research indicates that the majority of chatbots only respond to enquiries that are either defined in the database or come from a closed domain.
3. Ambiguity: When a sentence's context or meaning is unclear or serves no suitable function.
4. Language Structure: Each language has a different sentence structure. Every language, for instance, has its own set of conventions for punctuation, text organisation, and space usage. However, current chatbots are unable to discern it.
5. Words or phrases in a human natural language format are referred to as semantics. Current chatbots are unable to interpret real language, whether they are analysing queries or just displaying an answer.
6. Data processing: There is no relational database and the current chatbots do not directly handle the structured data. In addition, it is difficult to create datasets, and mapping utterances and entities is essential.
7. User Interface: Current chatbots' user interfaces are poor; they are not intuitive, and their documentation is appalling.

A new chatbot with deep learning skills must be created in order to get beyond all of the aforementioned restrictions. In addition to evaluating human input, it will be in charge of producing an appropriate response and recommending hospitals in the area depending on the user's location. Proper training will enable chatbots to swiftly and effortlessly understand human language and respond appropriately in any scenario. The main disadvantage is that it takes a significant amount of time and data to produce these inherent reactions, which means that a vast number of potential inputs must be learnt. Training will demonstrate if AI chatbots can tackle more complex issues that are a barrier for more straightforward chatbots.

VII- EXPERIMENTAL RESULTS

The Medical Symptom Checker is a modern online tool that looks at the symptoms people report to give quick and reliable health information. It features a simple chatbot that allows users to share their health problems and get accurate suggestions about possible conditions based on what they say. It is available all day, every day. This tool is easy to use, making healthcare more available by giving trustworthy health advice and helping users find the right care options.

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A. Home Page

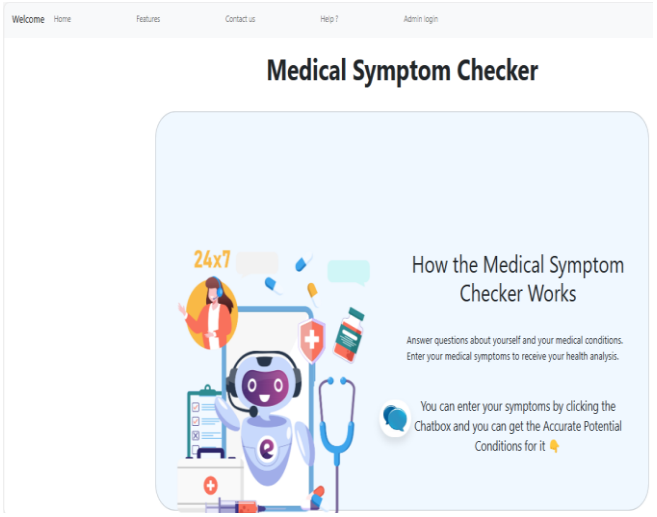

Fig.2 Home page

B. Symptoms checker page

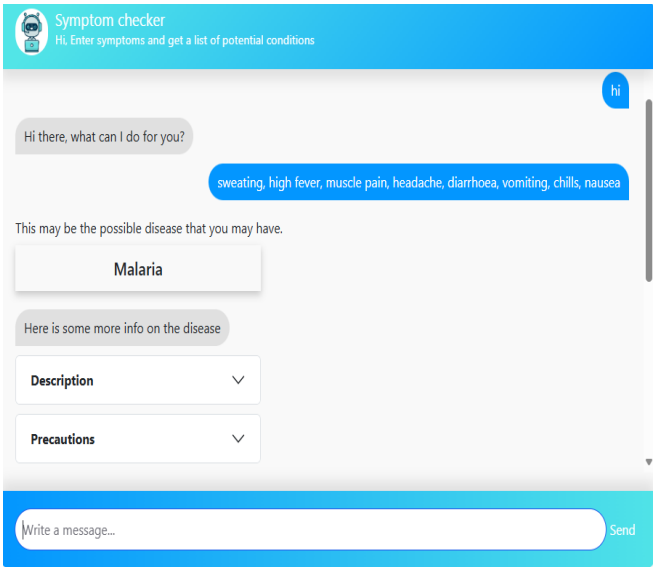

Fig.3 Predication page

This JSON dataset is created to help a chatbot learn how to identify and respond to symptoms of Malaria. It has labels to sort out diseases, common symptoms, and set responses that give advice on Malaria. This includes tips like drinking plenty of water, getting medical help, and using protection like mosquito nets and repellents. The chatbot uses this information to give helpful advice on how to find, handle, and stop diseases effectively.

VIII- FUTURE WORK

In our future projects, we need to include more models that are able to provide information about many other illnesses. We need to gather more information, improve our models to suggest nearby hospitals, increase the range of diseases that can be diagnosed. We would like to create a new platform based on a web app, for having the simplicity and beauty of the chatbot. Finally, there is only fifty kinds of illness examined in this paper, to add much more, we need more information, models that are able to suggest which hospital is nearby, to have the wider range of disease possible to diagnose. We would also like to be able to train the chatbot with a set way larger than the one that we used now. The goal is to use a model such as GPT-4, which would allow the chatbot to learn using the web and the ability to answer properly to some of his questions as well as the capability to explain them.

IX- CONCLUSION

In conclusion, we consider that our method will contribute added value if implemented along other methods currently being used within the domain of healthcare for the benefit of both health workers and patients. Using smart AI medical tools, the chatbot provides immediate advice by using clear symptoms. Hence, users can rely on getting helpful and easy-to-understand information. Moreover, the LSTM model efficiently handles data processing, allowing the chatbot to grasp and categorise the intention behind the statement made by the user and return accurate and relevant replies accordingly. In addition, owing to very powerful preprocessing chains which include tokenisation, distribution of resources, word packet transformations, etc., the input data provided undergoes standardisation and optimisation following the workflow pattern. Besides building a chatbot applying NLP with the use of RNN in python, the system demonstrates the utilisation of an advance level machine-learning technique in a real life context. For example, it gathers the users symptoms through interactions via created chatbot employing NLP and then applies a prediction model to diagnose disease precisely based on the symptom detected.

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