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A Survey on Medibot – Your Personalized Ai Health Companion

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ABSTRACT: Medibot is a state-of-the-art AI system designed to provide personalized health recommendations to users. This system provides text communication with the bot. The bot provides the information about the type of disease we have based on the user symptoms and can also predict the disease symptoms. Medibot will reply to the user's query within seconds. It will also suggest the nearby locations to consult the doctor based on the type of disease. The user can achieve the real benefit of the chatbot provided necessary information. Medibot is designed to be user-friendly and accessible, with a simple and intuitive interface that allows users to easily input their symptoms and receive personalized recommendations. One of the key benefits of Medibot is its ability to improve upon traditional methods for diagnosing. By leveraging advanced AI techniques such as natural language processing and machine learning, Medibot can provide personalized health recommendations that are tailored to each user's unique needs. It not only saves time and money, but also improves the overall quality of care received by patients. Patients may not always have access to medical care when they need it, leading to further complications and worsening conditions. Medibot aims to address these limitations by providing a personalized health companion.

Keywords: Artificial Intelligence, Chatbot, Natural Language Processing, Machine Learning, Cosine Similarity, TF-IDF, Long Short-Term Memory (LSTM),Recurrent Neural Network (RNN).

I. INTRODUCTION

Medibot, the revolutionary new system that combines Artificial Intelligence with healthcare to provide a personalized health companion for individuals. Health plays a major role in our lives. But sometimes it is very difficult to get the consultation with the doctor in case of any emergency. Our proposed idea is to create a healthcare chatbot system using Artificial Intelligence that can diagnose before consulting a doctor. In today's world, where healthcare can often feel impersonal and overwhelming, Medibot offers a solution that is tailored to each individual's unique needs and preferences. Medibot is poised to transform the way we think about healthcare. It allows individuals to take control of their own health and make informed decisions about their care. Additionally, it can help reduce the burden on healthcare providers by providing an efficient and effective means of diagnosis. As you can see, the potential benefits of Medibot are vast and far-reaching.

II. LITERATUREREVIEW

A Literature survey on healthcare chatbot provides a comprehensive overview of existing research, theories, and findings in this critical area of human resource management.

[1] DivyaMadhu, Neeraj Jain, et al., : The study focuses on developing a chatbot-based medical assistance platform leveraging a retrieval-based model of natural language processing (NLP). The system offers various features to aid patients, including real-time chat, symptom-based disease prediction, doctor suggestions, appointment booking, and mental health support. Utilizing decision tree algorithms for predictive modeling, the system aims to understand user queries and provide relevant responses. It integrates with a web application using technologies such as HTML, CSS, JavaScript, Python (Flask), and SQLite3, with the chatbot module powered by Dialogflow for natural language understanding. The architecture

incorporates user queries, intents, entities, and responses, facilitating seamless interaction. By integrating the chatbot with the web application, users can easily access medical assistance and support, thereby enhancing the efficiency and accessibility of healthcare services. The system employs two key algorithms to enhance its functionality: decision tree and keyword matching algorithms. Decision tree learning, a widely-used technique in data mining and machine learning, enables the system to predict and understand user queries effectively. By constructing decision trees based on observed data items, the system can draw conclusions and provide accurate responses to user inquiries. Additionally, the keyword matching algorithm plays a crucial role in processing user queries and retrieving relevant information from the knowledge base. This algorithm matches keywords extracted from user inputs with those stored in the database, facilitating efficient information retrieval and enabling the system to offer precise medical assistance through its chatbot interface. Together, these algorithms contribute to the system's ability to comprehend user queries, generate appropriate responses, and deliver effective medical support.

[2] PapiyaMahajan, RinkuWankhade, et al., : This study outlines a comprehensive approach to integrating expert system capabilities with user-friendly interfaces to provide medical assistance efficiently. The system allows users to interact with the chatbot through voice or text, leveraging an expert system to address queries and offer medical advice. Additionally, users can access information about available doctors for specific diseases and engage in online counseling sessions. Stored chatbot data in a pattern-template format facilitates future reference. The system's advantages include reducing healthcare costs, saving time, and eliminating the need for hospital visits even for minor issues. The architecture involves user-friendly conversation initiation with the chatbot, symptom clarification through a series of questions, categorization of diseases as minor or major, doctor suggestions for major diseases, and provision of analgesics and food suggestions for recovery. Dataflow diagrams depicts user input processing, symptom confirmation, disease categorization, and subsequent actions. The system incorporates three algorithms: N-gram, TF-IDF, and Cosine Similarity. N-gram algorithms help in understanding word sequences, TF-IDF scores the relative importance of words, and Cosine Similarity measures the similarity between vectors in an inner product space. These algorithms collectively enhance the system's ability to process user queries, provide accurate responses, and offer personalized medical advice, contributing to the system's effectiveness in providing remote healthcare assistance.

[3] Mr. Niraj A. Wanjari, et.al., The system integrates Artificial Intelligence capabilities to contribute to the healthcare sector, offering a linear user interaction design from symptom extraction to diagnosis and treatment suggestion. Leveraging the chatterbot Python library module, the system aims to address common health issues efficiently. It emphasizes patient engagement post-clinic or hospital visits, aiming to provide healthcare at lower costs. The chatbot system does not store personal user information, and its decision-making capabilities are augmented by custom Google search integration to provide comprehensive information from trusted sources. Built on Natural Language Processing principles and the chatterbot module, the system is trained to recognize keywords in user input, forwarding relevant information to the backend for processing. The system architecture and flowchart depict the seamless interaction process, emphasizing the training phase's importance in creating an effective AI-based healthcare chatbot system. Through experimentation, the system aims to identify diseases accurately based on symptoms provided by users, suggesting appropriate medications and facilitating appointment bookings. This approach showcases the system's potential in enhancing healthcare accessibility and efficiency through AI-driven solutions.

[4] Harsh Mendapara, SuhasDigole, et al., : This study investigates the development of a web application designed to assist users in obtaining information about their symptoms and accessing healthcare services. Initially, a chatbot is created to facilitate symptom extraction, which then integrates with hospital websites, allowing users to access medical information and staff details. The system database stores user records, while the backend processes chatbot inputs and executes actions in the database. Access to the system is granted to two entities: Admin and User, with Admin requiring login credentials for access. The user's text queries are analyzed using natural language processing, with a resolution engine making decisions based on input data, which is then forwarded to a custom data source. Output data undergoes grammar and syntax checks before being returned to the local server and displayed in the chatbot interface. Conversation records are

stored in the database, accessible to the admin for manipulation. The system uses backend development in Python, while the frontend utilizes HTML, CSS, and JavaScript. The chatterbot library facilitates conversation, with the application running on a localhost server. Training involves the creation of a new database and yml files, enhancing the chatbot's accuracy in responses. User interaction involves providing personal details, symptom discussion, medication suggestions, and appointment booking. Natural language processing aids in text analysis and tokenization, enabling the chatbot to understand and respond to user queries effectively. The system undergoes interface testing to ensure functionality. Overall, the system aims to streamline healthcare access through AI-driven solutions.

[5] M.V. Patil, Subhawna, et al., : In this research healthcare chatbot system utilizes various Python libraries to facilitate its operations, including Pandas, NumPy, and Scikit Learn. Pandas enables efficient data manipulation and analysis, while NumPy supports multidimensional arrays and mathematical functions. Scikit Learn offers versatile tools for classification, regression, clustering, and preprocessing tasks, enhancing the system's functionality. The algorithm employed by the chatbot involves a decision-making process based on patient responses to symptom prompts. If the patient confirms experiencing a particular symptom, the system identifies the corresponding disease along with other commonly related symptoms. This process continues iteratively until a disease is identified or all symptoms are exhausted. Experimental results demonstrate the system's effectiveness in disease identification and symptom listing based on patient input, showcasing its potential for healthcare applications. The unique features of the proposed system, including its focus on providing the highest possible outcome (disease or illness) based on user-provided symptoms and listing other related symptoms. The simplicity and adaptability of the algorithm suggest potential for further feature enhancement in the chatbot system. Overall, the integration of Python libraries and the iterative algorithmic approach contribute to the system's robustness and efficiency in providing personalized healthcare assistance.

[6] MayurDhavale, Sameer Gawade , et al., : This research focuses on the development of a healthcare chatbot system that aims to address the challenges of accessing medical practitioners personally by leveraging machine learning approaches. The system combines Natural Language Processing (NLP) and Neural Networks to provide reliable medical advice anytime users need it. Key components of the proposed system include a user-friendly interface, NLP models such as CNN and BERT, and neural network architectures like LSTM to interpret and respond to user queries effectively.Thechatbot system is designed to assist users in various healthcare-related tasks, including symptom assessment, providing health knowledge, scheduling appointments, and monitoring health indicators. By utilizing machine learning techniques and NLP, the chatbot can understand user inquiries, deliver tailored responses, and provide accurate medical information based on credible sources. To ensure privacy and security, the system follows strict rules to safeguard personal information. Additionally, the system undergoes testing to evaluate its accuracy, user satisfaction, response time, error rate, conversation completion, user engagement, handling complexity, and compliance with healthcare regulations. The chatbot employs NLP and LSTM algorithms for natural language understanding and sequential data processing, respectively. NLP enables the chatbot to comprehend patient inquiries and provide relevant answers, while LSTM networks capture and propagate critical information over extended sequences, making them suitable for tasks like speech recognition and time series prediction. Overall, the system aims to improve healthcare accessibility and convenience by providing users with a friendly and knowledgeable companion that can assist them with their health-related questions. The use of machine learning and NLP technologies enhances the system's ability to understand user queries, provide accurate responses, and deliver personalized healthcare assistance.

[7] BushraKidwai, NadeshRK : Thisreasearch study integrates a chatbot system designed to assist users with preliminary diagnosis based on symptoms input. Users can register on the portal and engage in live chat with a doctor, and in the absence of a doctor, the system provides a preliminary diagnostic chatbot. This chatbot utilizes Natural Language Processing (NLP) techniques to understand user queries, where initial symptoms input by the user forms the basis of a decision tree algorithm. The system architecture comprises modules for speech-to-text conversion, NLP-based intent understanding, and decision tree traversal until a diagnosis is reached. NLP involves tokenization to break down sentences into individual words or phrases, followed by syntactic analysis to ensure correct grammar usage. Semantic

analysis extracts the dictionary meaning of words, while pragmatic analysis interprets the actual meaning of sentences in context. The decision tree algorithm facilitates decision-making based on user inputs, with nodes representing symptoms, branches denoting outcomes, and leaf nodes containing possible diagnoses. The system relies on supervised learning using a curated dataset of diseases and symptoms, ensuring efficiency and accuracy in diagnosis. In terms of results, the system achieved an accuracy rate of 75% for common diseases, with 75 correct answers for every 100 queries. Overall, the system represents a promising approach to preliminary diagnosis in healthcare, leveraging NLP and decision tree algorithms to provide accurate and efficient assistance to users.

[8]SagarBadlani, TanviAditya, Meet Dave, SheetalChaudhari: In this study chatbot system is designed to provide users with disease prediction based on symptoms input or to offer relevant health-related information based on user queries. The system undergoes several stages, including data preprocessing, language selection, mode of communication selection, speech-to-text conversion, language translation, NLP text preprocessing, classification algorithms comparison, and response generation. The key algorithms used in this system include Random Forest Classifier, K-Nearest Neighbors (KNN), Support Vector Machine (SVM), Decision Tree, and Multinomial Naive Bayes (MNB). Data preprocessing involves converting the raw disease dataset into structured numerical data using count vectorization. The dataset consists of disease-symptom mappings, descriptions, and precautions. Language selection allows users to communicate in English, Hindi, or Gujarati, while the mode of communication can be either voice or text. Speech-to-text conversion is achieved using the SpeechRecognition library in Python, while language translation is performed using the Googletrans library. NLP preprocessing involves tokenization, stemming, stop words removal, and TF-IDF calculation to extract symptoms and keywords from user input. Cosine similarity is then applied to find the most appropriate response from the knowledge database. Classification algorithms comparison is conducted using Random Forest Classifier, KNN, SVM, Decision Tree, and MNB. The Random Forest Classifier outperforms the other algorithms, achieving an accuracy of 98.43%. The system then utilizes this classifier for disease prediction. The system's multilingual capability is demonstrated through conversation examples in English and Hindi languages, where the chatbot accurately predicts diseases based on user symptoms. Additionally, the system can respond to user queries using TF-IDF and cosine similarity techniques, providing relevant information from the knowledge database. Overall, the proposed system combines various algorithms and techniques to deliver accurate disease prediction and health-related information in a user-friendly manner.

[9] Kesavan, Tamilselvi and Krishnamoorthy, Ramesh Kumar : This study integrates various advanced techniques to enhance disease prediction accuracy. It leverages Recurrent Neural Networks (RNNs), particularly employing the RNN with Perception Algorithm (RNNPA) for preprocessing and training. RNNs are well-suited for sequential data processing, making them ideal for analyzing time-series medical data often encountered in disease prediction tasks. The use of RNNPA involves partitioning input signals among neurons in the hidden layer and employing back-propagation with a Stochastic-based Nelder-Mead method for error reduction, ensuring efficient training and optimization. The system incorporates ensemble classifiers, specifically VGG-16 and AlexNet, to capitalize on their capabilities in feature extraction from medical imaging data. These ensemble classifiers enhance the classification performance by combining multiple base models, each trained on different subsets of features or data representations. VGG-16 and AlexNet are renowned convolutional neural network architectures known for their effectiveness in image classification tasks, making them suitable for analyzing medical images and extracting relevant features for disease prediction. It utilizes a weighted model approach for finalizing disease severity levels. This involves calculating the weighted mean of variable inputs, prioritizing data elements with higher weights to make more informed predictions about disease severity. The weighted model helps in reducing the impact of noisy or less informative data points, improving the overall accuracy and reliability of the disease prediction system. The system represents a comprehensive approach to disease prediction, integrating state-of-the-art techniques in neural network modeling, ensemble learning, and weighted models to achieve robust and accurate predictions of disease occurrence and severity.

[10] Athulya N, Jeeshna K, S J Aadithyan, et al., : The study focuses on developing an AI-based healthcare chatbot to assist users in disease prediction and provide medical guidance. As

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technology continues to play a crucial role in our lives, leveraging Artificial Intelligence (AI) and Machine Learning (ML) algorithms becomes essential for enhancing healthcare services. Disease prediction, facilitated by big data analysis, contributes to improving the accuracy of risk classification, ultimately benefiting patients and healthcare professionals. In developing countries, establishing e-healthcare facilities faces challenges due to limited awareness and infrastructure development. Recognizing the growing reliance on the internet for healthcare-related queries, the paper proposes a platform for online medical services, aiming to bridge the gap between patients and healthcare providers. The introduction of a chatbot, powered by natural language processing (NLP) and ML algorithms, enhances communication efficiency and accessibility to healthcare resources. The proposed chatbot system utilizes a decision tree algorithm for disease prediction, enabling users to interact through both text and voice inputs. By extracting symptoms from user queries and employing the decision tree classifier, the chatbot predicts diseases and provides recommendations for further consultation with specialist doctors. The system's architecture encompasses modules for both administrators and users, ensuring seamless interaction and functionality. In the design phase, the development of a web-based interface using HTML facilitates user interaction and symptom input. The decision tree algorithm, a supervised learning technique, serves as the backbone of the system, guiding the prediction process based on symptom data. Precautionary measures and disease descriptions are provided to users based on the predicted disease, enhancing their understanding and awareness. Results indicate the effectiveness of the proposed system in facilitating one-on-one conversations between users and the chatbot, aiding in symptom analysis, disease prediction, and precautionary recommendations. The system's accessibility, convenience, and availability 24/7 contribute to its utility for users seeking medical assistance remotely. Overall, the literature survey underscores the significance of AI-driven healthcare chatbots in enhancing patient care and accessibility to medical services. Algorithms such as decision trees play a crucial role in disease prediction, symptom analysis, and response generation, thereby improving the overall efficiency and effectiveness of the healthcare chatbot system.

Paper	Year	Technology/Methodology	Pros	Cons
[1]	2016	Retrieval-based model of Natural Language Processing (NLP), Decision Tree algorithms, HTML, CSS, JavaScript, Python (Flask), SQLite3, Dialogflow	Offers real-time chat and symptom-based disease prediction. Integrates with web application for accessibility. Decision tree algorithm enhances predictive modeling.	Limited discussion on scalability and performance under heavy loads .
[2]	2020	Expert system, N-gram algorithm, TF-IDF algorithm, Cosine Similarity, Voice and text interaction, Pattern-template storage format	Efficient processing of user queries. Reduced healthcare costs and time savings Comprehensive approach to medical assistance.	Requires continuous updating of knowledge base for accuracy.
[3]	2022	Chatterbot Python library module, Custom Google search integration, Linear user interaction design	Lower healthcare costs, 24/7 availability. Utilizes AI capabilities for efficient patient engagement.	Lack of personalization in responses.
[4]	2021	Natural Language Processing, Chatbot application, SQL for database management, HTML, CSS, JavaScript for frontend	Facilitates symptom extraction and healthcare access. Backend development in Python for robustness.	Potential security concerns with user data storage.
[5]	2021	Python libraries including	Utilizes versatile Python	Limited discussion on

		Pandas, NumPy, Scikit Learn, Decision tree algorithm	libraries for efficient data processing. Focuses on personalized healthcare assistance.	scalability and performance under heavy loads.
[6]	2023	Natural Language Processing (NLP), Convolutional Neural Network (CNN), BERT (Bidirectional Encoder Representations from Transformers), Long Short-Term Memory (LSTM), Expert System Integration, Machine Learning Techniques	Enables comprehension of user inquiries. Delivers accurate, pertinent, and user-friendly answers. Effective for feature extraction in text data. Captures contextual information effectively. Well-suited for sequential data tasks like speech recognition and time series prediction. Accurate recommendations based on user queries and symptoms. Improves system response times and comprehension of intricate queries	Requires substantial training data for effective performance. May struggle with complex or ambiguous queries. Requires significant computational resources for training. High computational cost during training and inference. Requires substantial domain knowledge and expertise. May require frequent retraining to adapt to changing user needs or medical knowledge
[7]	2019	Natural Language Processing, Decision tree algorithm, Supervised learning, Speech-to-text conversion	Efficient preliminary diagnosis based on symptoms. 24/7 availability for healthcare assistance.	Accuracy rate may vary based on dataset quality and model training.
[8]	2021	Random Forest Classifier, K-Nearest Neighbors (KNN), Support Vector Machine (SVM), Decision Tree, Multinomial Naive Bayes (MNB), SpeechRecognition, Googletrans	Multilingual capability enhances accessibility. Accurate disease prediction based on symptoms.	Complexity in managing multiple classification algorithms.
[9]	2022	Recurrent Neural Network (RNN) with Perception Algorithm (RNNPA), Ensemble Classifiers (VGG-16 and AlexNet), Weighted Model Approach	Integrates multiple advanced techniques including RNN, ensemble classifiers, and weighted models for disease prediction. RNN captures temporal dependencies effectively, crucial for analyzing sequential medical data. Ensemble classifiers combine strengths of different models, enhancing classification performance. Weighted model approach prioritizes informative data elements, improving accuracy of disease	Computational complexity may be high, especially during training and inference. Requires careful tuning of hyperparameters and model architectures to achieve optimal performance. Integration of multiple techniques may increase the complexity of implementation and interpretation.

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			severity predictions.	
[10]	2021	NLP , Machine Learning (ML), Decision Tree algorithms, HTML, CSS, JavaScript, Python (Flask), SQLite3, Dialogflow	Real-time chat and symptom-based disease prediction. Enhanced communication efficiency and accessibility.	Potential scalability challenges under heavy loads.

COMPARATIVE ANALYSIS:

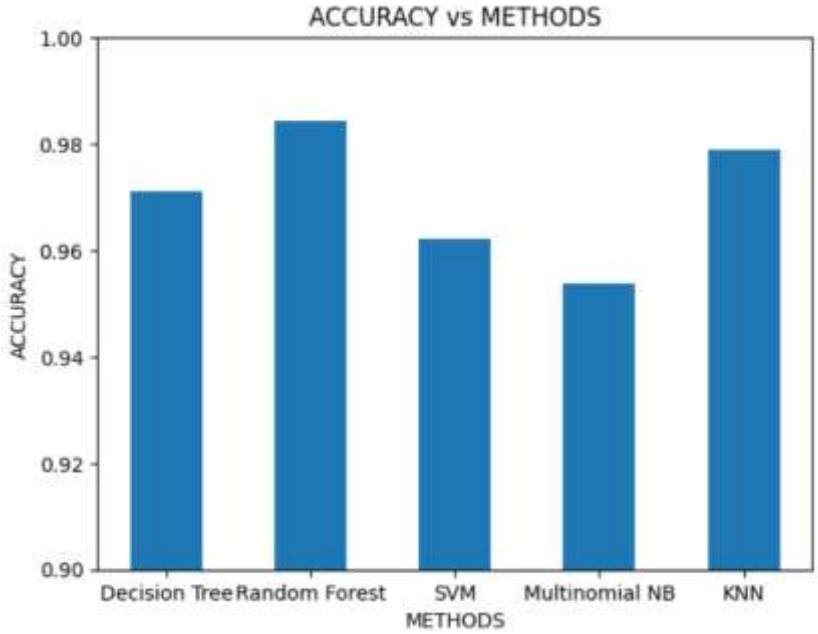

Figure 1: Graph depicting Accuracy of different methods

Figure 1 represents different methods used to create a bot that predicts the disease based on the symptoms and their accuracy.The research papers provide comprehensive insights into the performance of various methods, allowing us to ascertain the accuracy of each approach. The data presented in these papers serves as a valuable resource for evaluating and comparing the effectiveness of different methods. By analyzing the accuracy metrics derived from the research, we can gain aunderstanding of the strengths and limitations of each method.Utilizing the insights derived from our comprehensive research papers, we have successfully implemented various methods, each yielding distinct accuracies as detailed in Table 1. Based on the result we can say that the highest accuracy is given by Random Forest.

Methods	**Accuracy**
Random Forest	0.9843
Decision Tree	0.9712
K-Nearest Neighbors(KNN)	0.9788
Support Vector Machine (SVM)	0.9622
Multinomial NB	0.9539

Table 1: Accuracy of Methods

III. CONCLUSION

Medibot is a revolutionary personalized health companion that utilizes AI to provide accurate and timely health recommendations to users. With its ability to identify diseases based on symptoms and suggest appropriate cures, Medibot has the potential to transform the way we approach healthcare. By leveraging Natural Language Processing and Machine Learning, Medibot is able to provide personalized health recommendations that are tailored to each user's unique needs and preferences. It also enhances the overall user experience by providing a more intuitive and user-friendly interface.

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REFERENCES

[1]. DivyaMadhu, Neeraj Jain C. J, ElmySebastain, ShinoyShaji, AnandhuAjayakumar," A Novel Approach for Medical Assistance Using Trained Chatbot",International Conference 2016

[2]. PapiyaMahajan, RinkuWankhade, AnupJawade, PragatiDange, AishwaryaBhoge, "Healthcare Chatbot using Natural Language Processing", International Reasearch Journal of Engineering and Technology (IRJET), Volume 07, Issue 11, Nov 2020.

[3]. Mr. Niraj A. Wanjari, et.al., "AI Healthcare Chatbot Using Natural Language Processing", International Research Journal of Modernization in Engineering Technology and Science, Volume 04, Issue 05, May-2022.

[4]. Harsh Mendapara, SuhasDigole, Manthan Thakur, AnasDange, "AI Based Healthcare Chatbot System by Using Natural Language Processing", International Journal of Scientific Research and Engineering Development, Volume 4, Issue 2, Mar- Apr 2021.

[5]. M.V. Patil, Subhawna, Priya Shree, Puneet Singh, "AI based healthcare chat bot system", International Journal of Scientific & Engineering Research, Volume 12, Issue 7, July-2021

[6]. MayurDhavale, Sameer Gawade, SuyashRaskar, TejasMhaske, et.al., "AN AI-BASED HEALTHCARE CHATBOT MODEL FOR INFECTIOUS DISEASE PREDICTION", International Research Journal of Modernization in Engineering Technology and Science, Volume 05, Issue:11, November-2023

[7]. BushraKidwai, Nadesh RK, "Design and Development of Diagnostic Chabot for supporting Primary Health Care Systems", International Conference on Computational Intelligence and Data Science (ICCIDS 2019).

[8]. SagarBadlani, TanviAditya, Meet Dave, SheetalChaudhari, "Multilingual Healthcare Chatbot Using Machine Learning", 2021 2nd International Conference for Emerging Technology (INCET) Belgaum, India. May 21-23, 2021.

[9]. Kesavan, Tamilselvi and Krishnamoorthy, Ramesh Kumar. "An efficient recurrent neural network with ensemble classifier-based weighted model for disease prediction" Journal of Intelligent Systems, vol. 31, no. 1, 2022, pp. 979-991.https://doi.org/10.1515/jisys-2022-0068

[10]. Athulya N, Jeeshna K, S J Aadithyan, U Sreelakshmi, Hairunizha Alias Nisha Rose, "Healthcare Chatbot", © 2021 IJCRT | Volume 9, Issue 10 October 2021 | ISSN: 2320-2882.