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Emerging Role of Healthcare Chatbots in Improving Medical Assistance

Daram Sowmya
Dept. of Computer Science Engineering
B V Raju Institute of Technology
Narsapur, Medak, Telangana, India
21211a0566@bvrit.ac.in

Kousthubha Debbata
Dept. of Computer Science Engineering
B V Raju Institute of Technology
Narsapur, Medak, Telangana, India
21211a0568@bvrit.ac.in

Gunda Sai Vignesh
Dept. of Computer Science Engineering
B V Raju Institute of Technology
Narsapur, Medak, Telangana, India
21211a05a3@bvrit.ac.in

Dasari Subbayyagari Nandhu Sagar
Dept. of Computer Science Engineering
B V Raju Institute of Technology
Narsapur, Medak, Telangana, India
21211a0567@bvrit.ac.in

Anudeep Reddy Bavanthula
Dept. of Computer Science Engineering
B V Raju Institute of Technology
Narsapur, Medak, Telangana, India
21211a0530@bvrit.ac.in

Lanke Pallavi
Dept. of Computer Science Engineering
B V Raju Institute of Technology
Narsapur, Medak, Telangana, India
pallavi503@gmail.com

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***Abstract*—This study proposes integrating healthcare chatbots and assistive robots to address issues in densely populated areas with limited medical services. These robots offer benefits such as quicker and more accurate diagnoses, alleviating the workload of medical workers. The suggested healthcare chatbot enables efficient health inquiries through question-and-answer discussions. Users can input symptoms and receive ideas for suspected diseases, along with guidance on how to seek medical help. The chatbot uses natural language processing and machine learning. The chatbot compares symptoms to a database of recognized ailments, achieving an impressive 93% accuracy and outperforming existing models. The combination of accurate healthcare chatbots and assistive robots shows excellent potential for improving patient access and healthcare delivery, benefiting the medical sector.**

***Index Terms*—Natural Language Processing (NLP), Machine Learning (ML), Disease Prediction, Accuracy Enhancement, Doctor-patient ratio, Medical diagnosis, Ethical Considerations, Chatbot**

I. Introduction

Assistive robots are transforming the field of medical diagnosis by providing advanced capabilities to support healthcare professionals. These robots are designed to assist with various tasks, such as data collection, analysis, and decision-making, with the goal of improving patient care and outcomes. With advancements in robotics, artificial intelligence, and sensing technologies, assistive robots have the potential to revolutionize medical diagnosis by providing accurate and efficient assistance in complex clinical scenarios.

Medical diagnosis is a vital aspect of healthcare, as accurate and timely diagnoses are essential for effective treatment planning. However, medical diagnosis can be complex and challenging, requiring precise data collection, the analysis of large amounts of information, and expert decision-making. Assistive robots can play a significant role in supporting healthcare professionals by augmenting their capabilities in these areas. These chatbots can collect and process data from various sources, analyze it using advanced algorithms, and assist in making informed diagnoses, ultimately improving the accuracy and efficiency of medical diagnoses.

Advancements in robotics and AI technologies have paved the way for the development of sophisticated assistive robots for medical diagnosis. These robots can process and analyse complex medical data through their comprehensive sensors, AI capabilities, and machine learning algorithms that enable them to process and analyze complex medical data. For example, robots can assist in tasks such as endoscopy, where they can navigate through narrow passages, capture high-resolution images, or perform biopsies with precision. Moreover, robotic platforms can be used in remote diagnosis scenarios, allowing healthcare professionals to provide timely and accurate diagnoses even in remote or underserved areas, enhancing access to healthcare services.

Overall, assistive robots in medical diagnosis have the potential to revolutionize the field by providing advanced capabilities to support healthcare professionals, improving diagnostic accuracy, efficiency, and patient care. The advancements in robotics and AI technologies have opened up new possibilities for the integration of assistive robots into clinical practice, but ethical considerations must be carefully addressed. Further research and development in this field are needed to unlock the full potential of assistive robots in medical diagnosis.

II. Literature Survey

Shwetha M Patil et al. [4] published in the year 2022 in the field of Chatbots and Healthcare. The paper presents the design and implementation of a healthcare chatbot empowered by artificial intelligence. By leveraging natural language processing (NLP) techniques, the chatbot interacts with users and assists in identifying their symptoms, providing medical advice based on the reported symptoms. The proposed work aligns with the growing trend of utilizing

chatbot technology in healthcare.

S Nertinger et al. [5] paper aims to investigate the acceptance of remote assistive robots with and without a human-in-the-loop for healthcare applications. The authors describe the findings of a study involving participants who interacted with a remote robot for medical assistance tasks. The experiment compared the acceptance of a remote robot with and without a human-in-the-loop, where the human-in-the-loop condition involved a remote human operator who could assist the robot if necessary. The authors analyzed the participants' feedback and found that the human-in-the-loop condition led to higher levels of acceptance and trust in the remote robot system.

Lu Xu et al. [6] published in the year 2021 in the domain of Oncology and healthcare. The paper begins with an introduction to the background of chatbot technology and its relevance in various fields, including health care. The authors emphasise the prospects of machine learning, a subclass of AI (Artificial Intelligence), in facilitating complex dialog management and enabling conversational flexibility in healthcare settings. The results of the systematic study show that, while chatbots have the ability to address numerous areas of cancer therapy, human engagement in health care remains essential. The authors emphasise the use of chatbots in healthcare environment, collaborating with medical professionals to lower costs, increase workflow effectiveness, and improve patient outcomes. They also discuss the limitations and areas of concern surrounding chatbot implementation, such as ethical, moral, security, technological, and regulatory norms.

Athulya N et al. [7] published in the year 2021 in the field of Healthcare. The authors emphasize the evolution of chatbots from menu/button-based approaches to keyword-based and contextual-based models. Contextual-based chatbots leverage machine learning and artificial intelligence to store and process training models, allowing them to provide more accurate and appropriate responses when users ask domain-specific questions. The proposed medical chatbot aims to offer immediate and accurate disease predictions based on user-provided symptoms. The decision tree algorithm is employed for disease prediction in this project. By leveraging chatbot technology, the authors envision the potential for reshaping the healthcare industry through predictive diagnosis and improved accessibility to medical information. This literature survey highlights the growing significance of chatbots in healthcare and their potential to transform the industry by providing cost-effective and accessible healthcare solutions. Utilizing Machine Learning and Artificial Intelligence techniques enhances the chatbot's ability to accurately understand and respond to user queries. The authors' project focuses explicitly on disease prediction using a decision tree algorithm.

Yi Lai et al. [8] published in the year 2021. This paper provides an in-depth review of the existing literature on human-AI collaboration in the healthcare sector. It examines the potential benefits of such collaborations, including improved diagnosis accuracy, enhanced patient results, and increased healthcare delivery effectiveness. The authors also identify the challenges that need to be addressed to enable effective human-AI collaboration in healthcare, such as ethical considerations, trust, transparency, and user-centered design.

Obakeng L. Sehume et al. [9] published in the year 2020. This paper provides a comprehensive review of the current state of medical robotic assistive systems in South Africa for early diagnosis of common ailments. The authors assess the benefits, challenges, and limitations of these systems and suggest areas for future research and development to improve their effectiveness and accessibility.

III. EXISTING WORK

The existing work in the field of healthcare chatbots has focused on developing interactive systems that enable users to communicate with chatbots through various modalities, such as text and voice [10] [11]. These chatbots use natural language processing methods to comprehend user inquiries and deliver pertinent answers. However, previous systems have primarily focused on text-based or voice-based interactions, limiting the overall user experience.

Many of the current systems provide text-based chats. Some drawbacks of these Chatbots include the fact that patients must wait a long time for an expert's acknowledgement and that no immediate response is offered to them. Furthermore, the dataset comprises a handful of diseases. The existing system has technological issues, such as erroneous voice messages.

In our system, the user can communicate with the chatbot via text and voice, and it will respond in text and voice as well. If a user is conversing with the chatbot, the bot recognizes the ailment in relation to the user's requests. The bot recommends specialists that specialize in treating the user's problems and offers suggestions for treating them. There are no limitations on the number of concurrent users of this system.

In summary, our proposed work builds upon existing research by integrating text and voice-based interactions, incorporating disease identification capabilities, suggesting specialist doctors, and ensuring scalability for simultaneous users. These advancements contribute to an improved user experience and have the potential to enhance healthcare services by providing personalized and efficient assistance through the chatbot system.

IV. PROPOSED WORK

1) Chatbot UI: The chatbot UI (User Interface) is the visual interface through which users interact with the healthcare

chatbot [12]. It provides a user-friendly and intuitive design that allows users to input their queries, receive responses, and navigate through the chatbot's functionalities. The UI may include text input fields, buttons, menus, and other interactive elements to facilitate seamless communication.

2) Functioning Mechanism: The healthcare chatbot works by employing advanced technologies such as Natural Language Processing (NLP), machine learning algorithms, and a knowledge base. When a user interacts with the chatbot, the NLP component understands the user's intent, extracts relevant information, and processes the query. The machine learning algorithms analyze the input data and provide accurate responses or recommendations based on the context. The chatbot's knowledge base stores a vast collection of medical information, allowing it to provide reliable answers and assistance.

3) Development Process: The development of the healthcare chatbot involves a systematic approach encompassing multiple stages:

i. Requirement Analysis: The chatbot's requirements and objectives are identified, considering the target audience, desired functionalities, and integration with existing systems.

ii. Design: The chatbot's architecture, workflow, and user interface are conceptualized, ensuring a seamless and intuitive user experience.

iii. Data Collection: Relevant healthcare datasets, including symptoms, diseases, treatments, and medical guidelines, are gathered and processed for training and constructing the chatbot's knowledge base.

iv. Model Development: Machine learning models, such as NLP models and decision support algorithms, are created using the collected data. These models empower the chatbot to understand user queries, generate responses, and provide accurate recommendations.

v. Integration: The chatbot is integrated with existing systems, such as electronic health records (EHR) or knowledge databases, to access pertinent patient data and medical information.

vi. Testing and Refinement: Extensive testing is conducted to ensure the chatbot's accuracy, performance, and reliability. Feedback from users and healthcare professionals is incorporated to refine and enhance the chatbot's capabilities.

vii. Deployment: Once the chatbot has undergone thorough testing and validation, it is deployed in a suitable environment, such as a web platform or mobile application, making it accessible to users.

V. METHODS

1) Medical Literature and Research: Numerous health issues, symptoms, treatments, and recommendations are covered in great detail in medical literature and research articles. Developers of chatbots can use this information to gather precise and current data. Chatbots can respond to user inquiries with evidence-based information by pulling pertinent data from medical literature [13] . To comprehend and efficiently address user inquiries, chatbots require a substantial knowledge base. A useful source for building this knowledge base is the medical literature. The knowledge base of the chatbot can be expanded by developers by taking important information, medical jargon, and treatment recommendations from research publications.

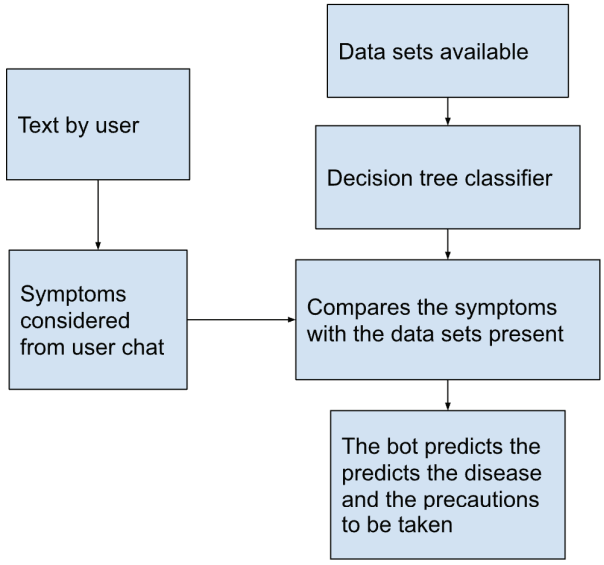

Fig. 1: Flow Chart

Figure 1: The healthcare chatbot engages users through a built-in interface and analyzes their medical questions and symptoms using natural language processing (NLP). It identifies essential signs from the user's input to predict potential diseases. The chatbot has access to an extensive dataset containing information on various diseases, their relevant symptoms, and corresponding precautions or treatment options.

Using a Decision Tree Classifier, the chatbot leverages machine learning techniques for feature selection and classification tasks. Based on patterns observed in the training datasets, the classifier predicts the most probable disease using the extracted symptoms as input. It compares the retrieved symptoms with those in the dataset and examines the connections between symptom combinations and different diseases.

Once the most likely ailment is diagnosed, the chatbot retrieves accompanying precautions and treatment suggestions from the dataset. It provides early guidance and support by outlining critical safety measures the user should take if they have the anticipated illness.

2) Natural Language Processing (NLP): In Building an AI-based healthcare chatbot, Natural Language Processing (NLP) is one of the important steps. The chatbot can understand and produce human language thanks to NLP algorithms, as well as collect pertinent data from user inquiries and respond in

a precise and useful manner. A few NLP techniques that are frequently applied to creating healthcare chatbots are listed below.

a. Tokenization: Tokenization is the process of breaking or segregating the text into smaller tokens. This helps the chatbot recognize the format of user input and successfully process it.

b. Name Enity Recognition (NER): NER is employed to extract entities or specific entities from user-provided text, such as symptoms and drugs. This makes it possible for the chatbot to take in and assess the information that the user has provided.

c. Intent Recognition: Intent recognition is the process of understanding the purpose of the query that is provided by the user. Using the concepts of deep learning and supervised learning, our chatbot can find the intention behind the user's search for information about the disease, medicine recommendations, and many more. Using this technique, the bot can provide relevant information.

3) Data Collection: Gathering relevant data is essential to training and fine-tuning the chatbot's algorithms and models. Depending on the specific application, data collection can involve sources such as electronic health records, medical literature, clinical guidelines, and publicly available health datasets.It is crucial to protect data privacy and adhere to ethical guidelines.

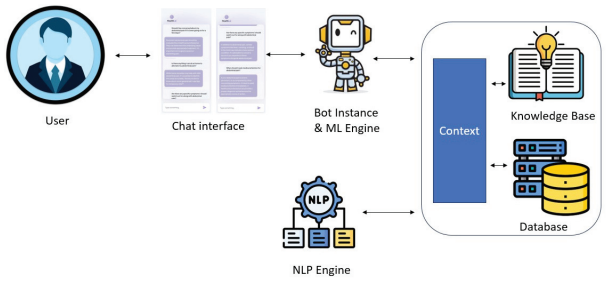

Fig. 2: Chatbot Architecture

- User: Engage in seamless interactions with our Chatbot, delivering personalized assistance at your fingertips.

- Chat Interface: Experience the user-friendly and intuitive chat interface, enabling effortless communication with our intelligent Chatbot.

- Bot Instance and ML Engine: Our Chatbot is powered by a state-of-the-art ML engine, ensuring dynamic responses and continuous improvement in understanding user needs.

- Context, Knowledge Base, Database: Benefit from the Chatbot's contextual awareness, extensive knowledge base, and data from a secure database for comprehensive and accurate information.

- NLP Engine: Unlock the power of natural language processing, enabling our Chatbot to comprehend, analyze, and respond effectively to diverse user queries.

4) Machine Learning (ML) Techniques: In order to understand user intent, categorize questions, and deliver pertinent responses, chatbots are frequently trained using ML approaches. Researchers apply methods including supervised learning, unsupervised learning, and reinforcement learning to develop trustworthy and accurate ML models.

a. Question Answering: ML techniques are used to develop question-answering systems within chatbots. These systems employ algorithms like information retrieval, text classification, or passage ranking to retrieve relevant information from knowledge bases, medical literature, or clinical guidelines. Transformer-based models like BERT (Bidirectional Encoder Representations from Transformers) have been widely used to improve question-answer accuracy.

b. Recommendation Systems: Based on their health-related questions or profiles, consumers can receive personalized suggestions from ML algorithms. To create personalized suggestions for healthcare services, treatments, or resources, collaborative filtering, content-based filtering, or hybrid approaches can be used to analyze user preferences, historical data, and similarity metrics.

5) Ethical Considerations: It is essential to make sure that chatbots that are concerned with health adhere to ethical standards. Researchers must take into account issues including data security, informed consent, privacy, and potential biases during the development process. The research should be conducted in accordance with ethical principles and frameworks, including those that are particular to AI and healthcare.

6) Electronic Health Records (EHR) Integration: Integrating with EHR systems allows the chatbot to access and retrieve relevant patient data, such as medical history, test results, or medication records. This integration enhances the chatbot's ability to provide personalized recommendations and assist in healthcare decision-making.

VI. Results and Discussions

The model we propose is structured, easy to access, and an effective way to help patients. This chatbot helps patients have question-and-answer-type conversations that help them learn about their health. Using this chatbot, patients may post their symptoms and get answers about what treatment to take, what precautions to take, etc. This chatbot can be used anywhere, anytime, 24/7.

Figure 3: A healthcare chatbot's symptoms page is made to assist users in determining potential diseases or conditions

based on their symptoms. It offers a simple user interface where people can enter the precise symptoms they are feeling. The chatbot then analyzes the input using its database and algorithms to produce a list of potential diseases or conditions linked to those symptoms. This tool can help users acquire a preliminary understanding of their health concerns and direct them towards seeking the right medical counsel or additional testing.

Figure 4: A healthcare chatbot's chat interface typically provides a user-friendly platform for people to explain their symptoms. These chatbots are designed to identify illnesses based on symptoms. Symptoms can be entered by the user via text or voice recognition. Natural language processing techniques are used by the chatbot to examine and comprehend user input. It then generates a list of possible diagnoses by comparing the reported symptoms with a database of recognized illnesses and their accompanying symptoms. The chatbot could pose follow-up questions to elicit more precise information. It will then provide pertinent details about each probable disease and suggest whether you should seek professional medical help or take care of yourself.

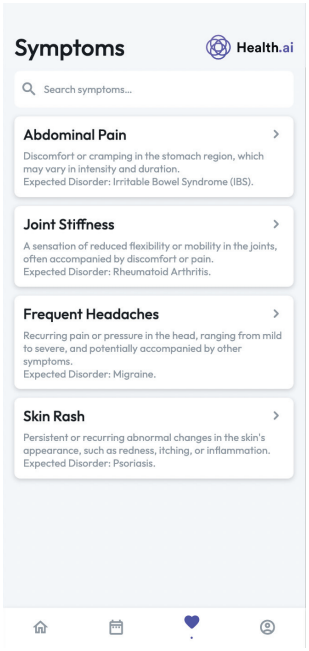

Fig. 3: Symptom Page of Chatbot Application

Table I: The information given displays the accuracy ratings of different machine learning models used on a healthcare dataset. After examining the data, it is clear that every model, with accuracy levels ranging from 93.2265% to 93.2270%, performs at a high level. This shows that these models excel at effectively categorising or forecasting outcomes connected to healthcare. The models with accuracy values of 93.2265% include Decision Tree, Logistic Regression, Random Forest, SVM, Neural Network, and KNN. These

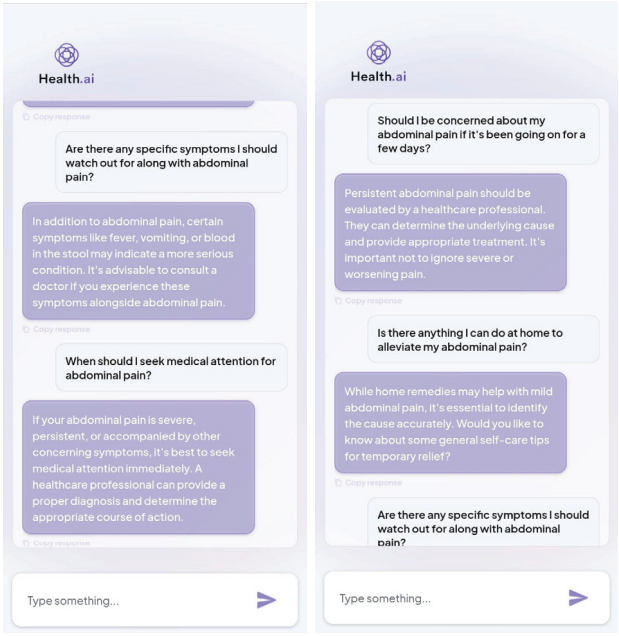

Fig. 4: Chat Interface of Chatbot Application

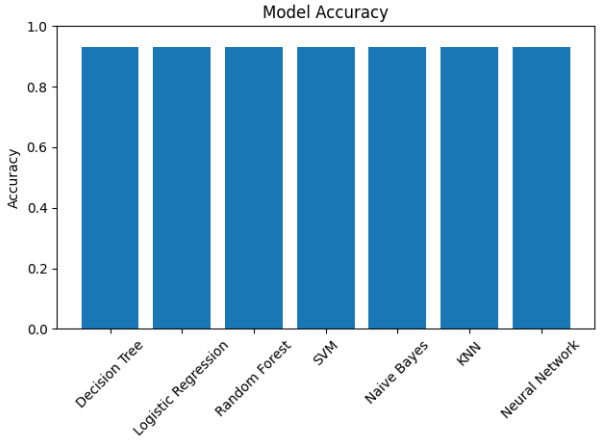

Fig. 5: Comparison Graph Between Different ML Models

models exhibit their effectiveness in dealing with the healthcare dataset, demonstrating their capacity to produce precise predictions and classifications. With a somewhat greater accuracy of 93.2270% than the other models, Naive Bayes slightly exceeds them. Utilising the independence assumptions between variables, Naive Bayes, which is based on probabilistic principles, exhibits its usefulness in the healthcare sector.

Table II: Our healthcare bot stands out among the five current models of healthcare chatbots with an outstanding accuracy of 93%. This shows that our model has received proper training and is able to assist people looking for health-care information by providing appropriate responses. The other models in the table that are presented in comparison also show decent levels of accuracy. With a 92% accuracy record,

TABLE I: Model Accuracy

S.No	Model	Accuracy
1	Decision Tree	0.932266
2	Logistic Regression	0.932265
3	Random Forest	0.932268
4	SVM	0.932266
5	Naive Bayes	0.932270
6	Neural Network	0.932266
7	KNN	0.932265

HealthAssist is a top contender in the industry. With accuracy ratings of 91% and 89%, CareChat and DocBot come in second and third, respectively. These models have established themselves as trustworthy sources for questions pertaining to healthcare. While still doing well in terms of accuracy, MedBot and MediCareBot (87% and 84%, respectively) lag behind the leaders.

TABLE II: Model Accuracy Comparison

S.No	Model	Accuracy
1	MedBot	87%
2	HealthAssist	92%
3	MediCareBot	84%
4	Docbot	89%
5	CareChat	91%
6	**Our Health ChatBot**	**93%**

VII. Conclusion

The future of medical diagnosis will witness a significant transformation with the continued advancements in assistive robots. Their ability to analyze medical data, provide real-time monitoring, offer decision support, and enable remote diagnostics holds tremendous potential for improving patient outcomes and enhancing the efficiency of healthcare systems. However, it is imperative to approach the integration of these technologies thoughtfully, addressing ethical concerns and establishing guidelines to maximize their benefits while ensuring patient safety and privacy. With the right implementation, assistive robots will undoubtedly play a vital role in shaping the future of medical diagnosis and revolutionizing healthcare delivery as we know it.

VIII. Future Work

Healthcare chatbot development is a growing field of study and innovation. Here are some potential future paths for healthcare chatbot development:

1. Healthcare chatbots have the ability to give experts in the field useful decision support. In the future, work on chatbot algorithms may concentrate on incorporating clinical recommendations, medical databases, and research findings to help with diagnosis, treatment planning, and advising evidence-based practices.

2. Chatbots can be made more efficient by responding to the needs of specific users and taking the conversation's context into account. Future work might incorporate real-time data, user preferences, and medical history. Healthcare chatbots can be improved to display emotional intelligence and empathy, which can help patients feel more comforted and cared for.

3. Possibly in the future, we may also enable the camera feature. Based on the analysis of the wound image and the reports, the chatbot would generate a severity assessment. It could provide a preliminary evaluation of the wound, categorizing it as minor, moderate, or severe. The assessment could also take into account factors like the risk of infection or complications based on the characteristics of the wound.

References

[1] L. C. Budler, L. Gosak, and G. Stiglic, "Review of artificial intelligence-based question-answering systems in healthcare," *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, vol. 13, no. 2, p. e1487, 2023.

[2] J. C. Chow, L. Sanders, and K. Li, "Impact of chatgpt on medical chatbots as a disruptive technology," *Frontiers in Artificial Intelligence*, vol. 6, p. 1166014, 2023.

[3] J. W. Ayers, A. Poliak, M. Dredze, E. C. Leas, Z. Zhu, J. B. Kelley, D. J. Faix, A. M. Goodman, C. A. Longhurst, M. Hogarth *et al.*, "Comparing physician and artificial intelligence chatbot responses to patient questions posted to a public social media forum," *JAMA internal medicine*, 2023.

[4] S. M. Patil, S. Sneha, S. Varshini, U. Joshi, and M. Kavya, "Design & implementation of healthcare chatbot using artificial intelligence," *INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) RTCSIT*, vol. 10, no. 12, 2022.

[5] S. Nertinger, R. J. Kirschner, A. Naceri, and S. Haddadin, "Acceptance of remote assistive robots with and without human-in-the-loop for healthcare applications," *International Journal of Social Robotics*, pp. 1–20, 2022.

[6] L. Xu, L. Sanders, K. Li, J. C. Chow *et al.*, "Chatbot for health care and oncology applications using artificial intelligence and machine learning: systematic review," *JMIR cancer*, vol. 7, no. 4, p. e27850, 2021.

[7] N. Athulya, K. Jeeshna, S. J. Aadithyan, U. Sreelakshmi, and H. Alias Nisha Rose, "Healthcare chatbot," *International Journal of Creative Research Thoughts (IJCRT)*, vol. 9, no. 10, pp. 65–70, 2021. [Online]. Available: http://www.ijcrt.org/papers/IJCRTH020011.pdf

[8] Y. Lai, A. Kankanhalli, and D. Ong, "Human-ai collaboration in healthcare: A review and research agenda," 2021.

[9] O. L. Sehume and E. D. Markus, "A critical analysis of medical robotic assistive systems for early diagnosis of common ailments in south africa," *Int J Mech Eng Robot Res*, vol. 9, no. 10, pp. 1451–1456, 2020.

[10] S. Raje, N. Reddy, H. Jerbi, P. Randhawa, G. Tsaramirsis, N. V. Shrivas, A. Pavlopoulou, M. Stojmenović, D. Piromalis *et al.*, "Applications of healthcare robots in combating the covid-19 pandemic," *Applied bionics and biomechanics*, vol. 2021, 2021.

[11] T. Cheng, W. Li, W. Y. Ng, Y. Huang, J. Li, C. S. H. Ng, P. W. Y. Chiu, and Z. Li, "Deep learning assisted robotic magnetic anchored and guided endoscope for real-time instrument tracking," *IEEE Robotics and Automation Letters*, vol. 6, no. 2, pp. 3979–3986, 2021.

[12] Shubha and M. Meenakshi, "Design and implementation of healthcare assistive robot," in *Proceedings of the 2019 5th International Conference on Advanced Computing and Communication Systems (ICACCS)*, 2019.

[13] S. S. Chempolil, R. M. Basaiawmoit, S. Saji *et al.*, "Design of a medical prototype robot for nurse assistance," in *2021 Seventh International Conference on Bio Signals, Images, and Instrumentation (ICBSII)*. IEEE, 2021, pp. 1–5.

[14] S. F. Ahmed, I. J. Kiwarkis, A. B. Mohammed, A. H. Mohammad, A. A. Mihi, M. S. Saeed, B. D. Diwali, and Huang, "Design and development of assistive robotic system for covid-19," in *Proceedings of the 2020 IEEE 7th International Conference on Engineering Technologies and Applied Sciences (ICETAS)*, 2020.

[15] Y. Song, "Modeling and control of three-degree-of-freedom medical assistant robot," in *Proceedings of the 2020 5th International Conference on Mechanical, Control and Computer Engineering (ICMCCE)*, 2020.