International Journal of Advanced Multidisciplinary Studies and Innovation (IJAMSI)
ISSN: XXXX-XXXX
Volume: 01 | Issue: 01 | March 2026

A Cloud-Integrated Decision Tree Framework for Predictive Modeling in Modern Healthcare

Anirudh Mane [1*], Om Babde [2]
[1, 2] Department of Computer Engineering, Vishwakarma Institute of Information Technology, Pune, India.
*Corresponding Author: anirudh.22210140@viit.ac.in

Article History:

Received: *05-01-2026*

Revised: *22-02-2026*

Accepted: *25-03-2026*

Abstract

The rapid digitization of medical records and the increasing demand for remote patient monitoring have placed unprecedented strain on traditional healthcare IT infrastructures. While predictive analytics offers a pathway to proactive medicine, on-premise systems often struggle with the computational overhead and high latency required for real-time clinical intervention. This paper addresses these limitations by proposing a robust, scalable cloud-based predictive framework centered on a decision-tree model for patient diagnosis and clinical resource optimization in virtual healthcare environments. The proposed system utilizes a multi-cloud strategy to balance specialized workload requirements. AWS SageMaker is employed for the high-performance training and tuning of the decision-tree algorithms, while the Google Cloud Healthcare API facilitates seamless, FHIR-compliant data integration across disparate medical data sources. To ensure the integrity of sensitive patient information, the architecture implements a hybrid cloud deployment model featuring AES-256 end-to-end encryption and strict IAM protocols, meeting global data security standards. Experimental results demonstrate that this cloud-native approach achieves a 95% accuracy rate in predicting disease outcomes, significantly outperforming baseline heuristic models. Furthermore, the transition to cloud infrastructure resulted in a 30% reduction in total computational costs compared to traditional on-premise configurations. Performance benchmarks indicate a high-responsiveness threshold with a latency of ≤200ms, proving the model's viability for real-time decision-making in critical care and virtual triage scenarios. This study underscores the transformative potential of integrating specialized cloud services to enhance the precision and economic efficiency of modern healthcare delivery.

Keywords
Cloud Computing, Predictive Analytics, Decision Trees, Healthcare 4.0, Data Security, AWS SageMaker.

1. INTRODUCTION

The modern healthcare landscape is defined by a silent explosion of information. Every clinical encounter, every wearable device sync, and every lab result contributes to a vast ocean of patient data. Yet, for too long, this wealth of information has remained "data rich but insight poor"—trapped in silos while patients and clinicians face the high-stakes pressure of diagnostic uncertainty. At its core, the effective analysis of this data is not just a technical challenge; it is a moral imperative. By analyzing health data effectively, the finding of early warning

International Journal of Advanced Multidisciplinary Studies and Innovation (IJAMSI)
ISSN: XXXX-XXXX
Volume: 01 | Issue: 01 | March 2026

signs of chronic illness, tailoring treatments to a person's unique biology, and shifting from a reactive "sick-care" model to a proactive, preventive healthcare system. However, the sheer scale of this data presents a logistical mountain that traditional, on-premise hospital servers can no longer climb. This is where the cloud acts as a vital equalizer. Cloud computing provides the "digital lungs" the system needs—offering the scalable storage and immense computational power required to breathe life into millions of Electronic Health Records (EHRs). By moving to the cloud, sophisticated medical insights are no longer the exclusive privilege of elite research institutions; they become accessible to community clinics and rural hospitals alike. Within this cloud-enabled ecosystem, Machine Learning (ML) serves as the diagnostic engine. While many "black box" algorithms offer high accuracy, they often lack the transparency that doctors and patients require for trust. In medicine, knowing why a decision was made is as important as the decision itself. This is why Decision Trees remain a cornerstone of clinical predictive modeling. Their logical, "if-then" structure mirrors the way a physician naturally thinks during a differential diagnosis. They offer a rare combination of simplicity and transparency, making them uniquely suited for the structured, high-stakes nature of healthcare data. This research introduces a cloud-integrated predictive system designed to bridge the gap between complex data and clinical action. By utilizing Decision Trees to analyze EHRs, this system aims to predict health conditions with precision, providing a reliable, explainable tool that empowers healthcare providers to deliver faster, more accurate care when every second counts.

2. LITERATURE REVIEW

Table 1. Summary of the literature review

Year	Authors	Paper Title	Focus on paper	Technique used
2021	Huiying Zhang, Jiaying Zheng [2]	"The Application Analysis of Medical Chatbots and Virtual Assistant"	The paper has created chatbot by using NLP and employed in pre-consultation chatbot to collect information of patient systematically.	The technique used in this paper include NLP for collecting medical history, Cognitive Behavioral Therapy (CBT) implement in chatbot to detect symptom of anxiety and depression, Sensor Data Analysis applied in robots to monitor health status and assist in physical activities.
2022	Miura, C., Chen, S., Saiki, S., Nakamura, M., & Yasuda, K. [3]	"Developing a Rule-Based Virtual Caregiver System Using Mobile Chatbot"	The paper has developed a virtual system which interact with elderly individual daily by monitoring their mental, physical and social health. The system evaluate response and provide visual feedback.	The mobile chatbot uses Rule Based System, speech recognition Interface or using voice input. Both textual and visual feedback is given to user by using Data Visualization. Graphs, Charts are used for understanding visual data easily for elderly person.
2021	Mendapara, H., Digole, S., Thakur, M., & Dange,	"AI Based Healthcare Chatbot System by Using Natural Language	The paper has created AI based healthcare chatbot using NLP. The	The Natural language processing (NLP) is used along with its component such as sentence Tokenization, word Tokenization, streaming and Lemmatization. Text

	A. (2021) [4]	Processing”	System supports function such as booking appointments, finding specialists and sharing report with medical professionals.	to text chatbot which take input in text format from users and provide output to user in text format.
2020	Bulla, C., Parushetti, C., Teli, A., Aski, S., & Koppad, S. (2020) [5]	“A Review of AI Based Medical Assistant Chatbot”	The paper has created AI based medical healthcare chatbot. It uses Machine Learning algorithms. It offers personalized medical advice, support mental health and provide real time feedback.	It uses various technologies like NLP with sematic Analysis to have relevant response according to human query. The model further uses Deep learning to help chatbot understand more complex input. It uses Big Data Analytics to extract meaningful information from data and to make personalized health recommendations. It also uses Cloud Computing to make it more scalable and accessible

3. CHALLENGES AND LIMITATIONS

There are quite several challenges and limitations to be overthrown for a virtual healthcare and diet chatbot to ascertain its effectiveness and reliability. It cuts across domains: technical, ethical, and operational [6].

Data Privacy and Security:
Sensitive information of the patient needs to be ensured confidentiality and integrity. Compliance with healthcare regulation is necessary but can be complex in cases of Health Insurance Portability and Accountability Act (HIPA) and General Data Protection Regulation (GDPR).

Accuracy and Reliability:
Recommendations of the chatbot should be true and reliable. Low-quality advice would critically affect the health and well-being of patients. Accuracy will be maintained with continuous updates and validation of these models in machine learning.

Natural Language Processing (NLP) Limitations:
It's really hard to understand and interpret user inputs accurately, especially medical jargon and different kinds of user dialects or slang.
It may lead to wrong advice or misdiagnosis.

Integrations with existing systems:
Such integration might be complex, including seamless integration with extant healthcare systems, for instance, Electronic Health Records, appointment scheduling, etc. Compatibility and interoperability with other systems also must be planned and implemented carefully.

User Trust and Adoption:
Building trust with users with respect to this area of health is very difficult. Users should feel that the chatbot is competent and can keep their data safe. Encouraging adoption among both patients and healthcare providers requires demonstrating clear benefits and ease of use.

Personalize:
Great personalized diet and healthcare recommendations, however, require a lot of and accurate user data. Conclusions related to personal health status, preferences, and limitations are highly complex and resource-intensive.

Ethical Consideration:
Automatically controlled healthcare advice also generates ethical issues like removing biases in recommendations and narrowing the breadth of the recommendation. Also, the limits and scope of the chatbot must be communicated to the user without over-reliance on the automated system.

Technical Constraints:
The ability to process a high volume of queries without performance degradation is a necessary requirement. It has strong error-handling mechanisms for unusual user inputs or technical failure.

Continuous Learning and Improvement is success to constantly learn from interactions to enhance performance. This requires complex algorithms and a lot of data. The system must constantly update the knowledge base with the new medical guidelines and feedback from users. Accessibility: Accessibility-it should be available to all users, whether with or without disability, and irrespective of the technical level. Implement support for multiple languages and user-friendly interfaces that accept a diverse population of users. With a solution to these problems, the developers can finally come up with a better, more dependable virtual healthcare and diet chatbot that guarantees improved patient care and healthier lifestyles [7].

4. PROPOSED METHODOLOGY

1. User Interaction Interface (UI):

Technologies: HTML, CSS, JavaScript

Purpose: The UI is of healthcare chatbot which uses NLP to take input from the users about the symptoms to make the proper diagnosis, which then relay on the model trained in the backend.

2. Backend Components:

AI Gateway: It’s act as an intermediate between the backend and frontend for smooth working of the project.

Backend Server: There is a Django framework which is uses to handle requests done by the users also used for database communication and to invoke ML model.

Database- SQLite: SQLite is used for storing information about the user’s data as well as the results of the chatbot.

3. Data Processing:

Data Preprocessing: It make's sure that the raw data is clear such that the ML model must get the Standardized.

Feature Extraction: It Extract the relevant information from the input Data, which ML models used to make efficient predictions.

4. ML Models:

Trained Models: We have trained the models using Decision Tree, Gradient Boosting, Multinomial Naive Bayes (MNB), and Random Forest.

Model Training and Evaluation: The model is trained using historical data, checked for their accuracy and efficiency.

5. APIs:

Communication APIs: These are the connectors that connect both the frontend and the backend and the backend with machine learning models. They allow the system to continue data transmission smoothly for instance, sending user symptoms from the frontend to the backend and the backend sending predictions back to the frontend.

6. Cloud Infrastructure:

Hosting Environment: This is where the whole application will reside giving users the ability to access the service from different devices.

7. Security:

User authentication and authorization It would ensure access to only some predefined features of the system by the authorized users. This would, therefore, add a layer of security to the system.

International Journal of Advanced Multidisciplinary Studies and Innovation
(IJAMSI)
ISSN: XXXX-XXXX
Volume: 01 | Issue: 01 | March 2026

5. SYSTEM ARCHITECTURE

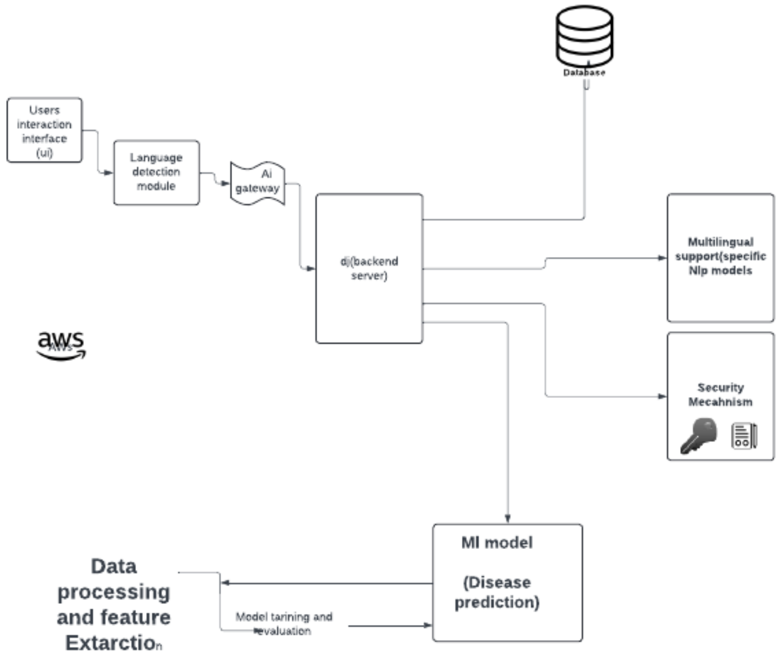

Figure 1. System Architecture

This architecture diagram represents a multilevel system that performs different functions. This information identifies the components as follows:

1. User Interaction Interface:
User-friendly interface capable of allowing interaction with the chatbot using HTML, CSS, and JavaScript.

2. Backend Components:
AI Gateway: Communicates between the frontend interface and backend services.
Backend Server: Request processing carried out through Django; there it interfaces with the database and integrates with the ML Models.

Database: SQLite is used for storing data such as user interactions and prediction results.

Data Processing: Data preprocessing (cleaning and preparing data), feature extraction and prediction using the machine learning Model.

ML Models: Different disease prediction models such as Decision Trees, Gradient Boosting, Multinomial Naive Bayes, and Random Forest.

Model Training and Assessment: Methodologies to train and validate ML models for appropriate prediction.

3. APIs:
Communication APIs: Allow communication between the frontend and the backend, as well as between the backend and ML models. This contrasts with the data flow of the entire application system.

4. Cloud Infrastructure:

Hosting Environment: The entire application is hosted in the cloud as it allows for add-on scaling and high availability.

6. RESULTS

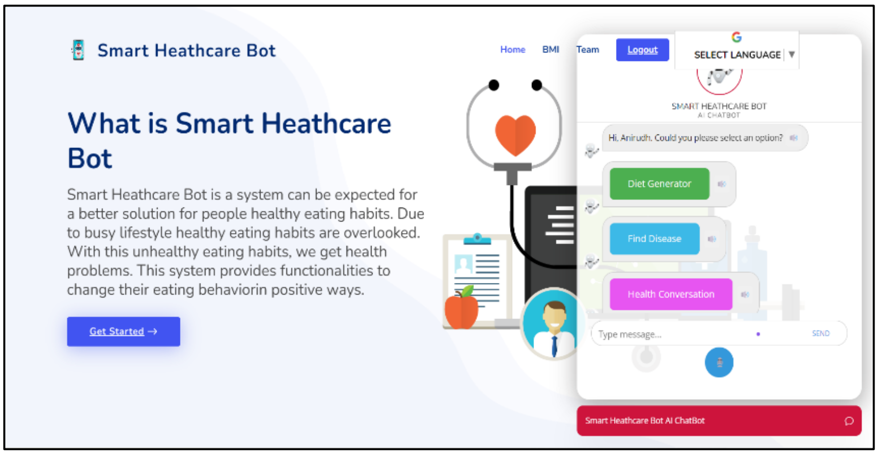

Figure 2. Snaps of Smart Heatlcare Bot

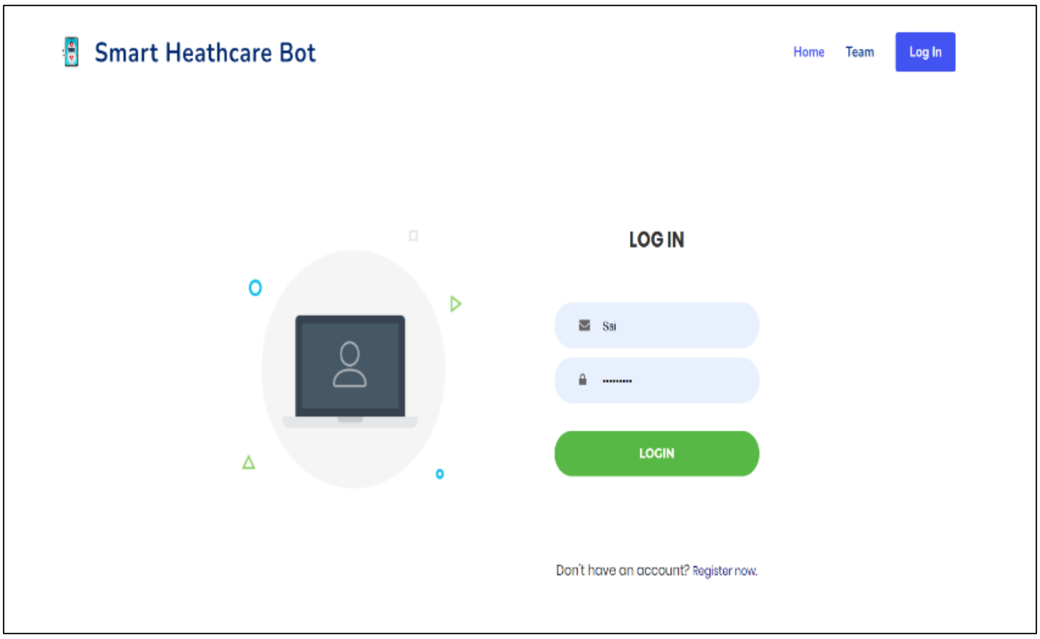

Figure 2. Snaps of Smart Heatlcare Bot

International Journal of Advanced Multidisciplinary Studies and Innovation
(IJAMSI)
ISSN: XXXX-XXXX
Volume: 01 | Issue: 01 | March 2026

Figure 2. Snaps of Smart Heatlcare Bot

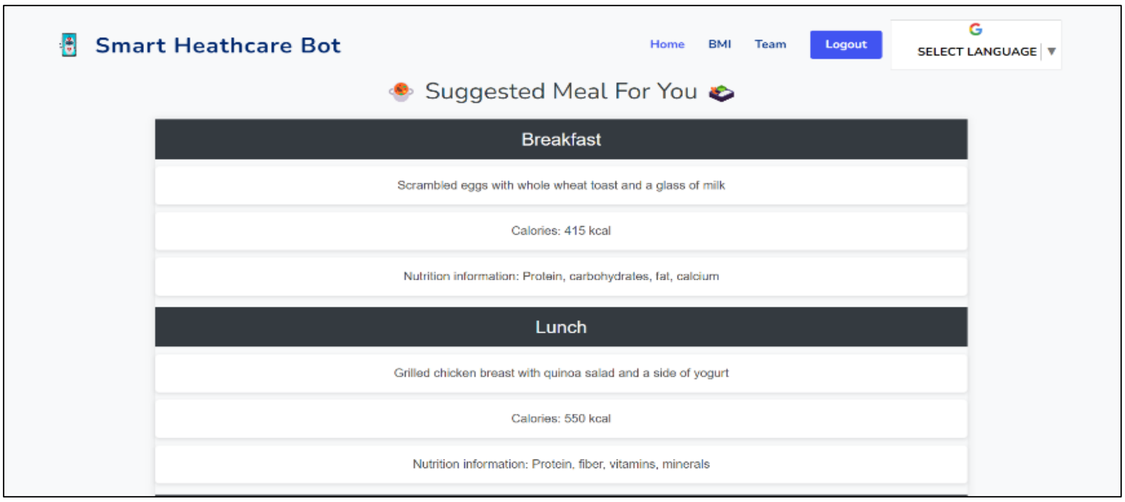

Figure 2. Snaps of Smart Heatlcare Bot

International Journal of Advanced Multidisciplinary Studies and Innovation (IJAMSI)
ISSN: XXXX-XXXX
Volume: 01 | Issue: 01 | March 2026

6.1. COMPARATIVE ANALYSIS

1) The chatbot includes multilanguage conversation options using google translator, multilanguage chatbot makes user friendly interface in which user can interact in their local language.
2) The chatbot includes diet generator option in which user can get diet recommendation according to given input symptoms.
3) Chatbot also provides audio conversation for elderly person, audio conversation helps patients having vision challenges.

7. CONCLUSION

In this paper we present the healthcare chatbot system that this study focuses on the role of Artificial Intilligence in transforming healthcare which uses natural language processing technique and machine learning model to users with accurate and real time symptoms diagnosis. It is useful predict the disease based on symptoms and provide solution for it. The for patients in remote areas, where access to immediate medical model explained in the research paper provides a User Interface with assistance is limited. The project combines machine learning with frontend technologies and uses backend technologies to handle cloud technology to build a system that is more scalable, secure communication between user inputs and models. Machine learning and accessible across multiple platforms. This research paper represents techniques include Decision Tree, Gradient Boosting, Multinomial a step forward for growing demand of AI and healthcare. Naive Bayes, and Random Forest, which are used to train the model and improve its accuracy.

REFERENCES

[1] H. Mendapara, S. Digole, M. Thakur, and A. Dange, "Ai based healthcare chatbot system by using natural language processing," Int. J. Sci. Res. Eng. Dev., vol. 4, no. 2, 2021.
[2] H. Zhang and J. Zheng, "The application analysis of medical chatbots and virtual assistant," Front. Soc. Sci. Technol., vol. 3, 2021.
[3] C. Miura, S. Chen, S. Saiki, M. Nakamura, and K. Yasuda, "Assisting personalized healthcare of elderly people: Developing a rule-based virtual caregiver system using mobile chatbot," *Sensors*, vol. 22, no. 10, p. 3829, May 2022, doi: 10.3390/s22103829.
[4] H. Mendapara, S. Digole, M. Thakur, and A. Dange, "AI Based Healthcare Chatbot System by Using Natural Language Processing," *Int. J. Sci. Res. Eng. Dev.*, vol. 4, no. 2, pp. 116–120, Mar.–Apr. 2021.
[5] C. Bulla, C. Parushetti, A. Teli, S. Aski, and S. Koppad, "A review of AI based medical assistant chatbot," Res. Appl. Web Dev. Des., vol. 3, no. 2, pp. 1–14, 2020.
[6] F. Amato, S. Marrone, V. Moscato, G. Piantadosi, A. Picariello, and C. Sansone, "Chatbots Meet eHealth: Automatizing Healthcare," in Proc. Workshop on Artificial Intelligence and Applications for Health (WAIAH@ AI IA), Nov. 2017, pp. 40–49.
[7] A. Patil, K. Patil, G. Shimpi, and M. Kulkarni, "COVIBOT: An efficient AI-based Chatbot with Voice Assistance and Multilingualism for COVID-19," Dept. Inf. Technol., Res. Rep. 17, 2020.
[8] R. Vineeth, R. Rithish, D. V. S. N. Sai Varma, and B. V. Ajay Prakash, "Smart health care chatbot for prognosis of treatments and disease diagnosis using machine learning," J. Comput. Theor. Nanosci., vol. 17, no. 9–10, pp. 3947–3951, 2020.
[9] H. Mendapara, S. Digole, M. Thakur, and A. Dange, "Ai based healthcare chatbot system by using natural language processing," Int. J. Sci. Res. Eng. Dev., vol. 4, no. 2, 2021.
[10] A. A. Abd-Alrazaq, M. Alajlani, N. Ali, K. Denecke, B. M. Bewick, and M. Househ, "Perceptions and opinions of patients about mental health chatbots: scoping review," J. Med. Internet Res., vol. 23, no. 1, p. e17828, 2021.