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AI-DRIVEN MEDICAL CHATBOT FOR INTERACTIVE DIAGNOSTICS

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ABSTRACT

In order to detect diseases in an efficient as well as an easy way, we are proposing a medical chatbot framework. This work investigates about the diseases by simply taking various symptoms related to a particular disease. To accomplish this, we use different datasets related to diseases, we apply various Deep Learning and Machine Learning algorithms and ensemble them together to anticipate about diseases. Machine Learning Techniques can give productive outcome to gather information by building different grouping and outfit models from gathered dataset. Such gathered information can be valuable to anticipate diseases. Different strategies of Machine Learning and Deep Learning are able to do forecast, but it's difficult to pick a best strategy. For this system, we have implemented Natural Language Processing and Artificial Neural Network in order to get the best efficiency.

KEYWORDS: **Natural Language Processing (NLP), Long Short Term Memory(LSTM), Machine Learning(ML), Decision Tree, Random Forest , KNN.*

1.INTRODUCTION

1.1 MOTIVATION

The motivation for developing an AI-driven medical chatbot for interactive diagnostics is driven by the need to bridge the gap in healthcare accessibility, reduce the burden on overburdened medical systems, and provide immediate, personalized health guidance. These systems use Natural Language Processing (NLP) and Machine Learning (ML) to simulate human interaction for symptom analysis and preliminary disease prediction**.**

1.2 OBJECTIVE OF THE PROJECT

The core objective of an AI-driven medical chatbot for interactive diagnostics is to provide accessible, rapid, and preliminary medical insights by simulating human conversation, thereby enhancing patient engagement and enabling early identification of health issues. These systems are designed to act as a bridge between users and professional healthcare services, rather than a replacement, optimizing the triage process and reducing the strain on medical resources.

1.3 CHALLENGES

Implementing a MediBot (AI-powered medical chatbot or physical robot) project to enhance healthcare accessibility faces significant challenges across technological, ethical, and logistical domains. While intended to bridge gaps in underserved areas, these projects often encounter limitations in infrastructure, user trust, and regulatory compliance.

1.4 PROBLEM DOMAIN

The problem domain of an AI-driven medical chatbot for interactive diagnostics lies at the intersection of healthcare, artificial intelligence (specifically Natural Language Processing), Human-Computer Interaction. Its primary goal is to provide accessible, 24/7 preliminary medical assessment, symptom checking, and guidance, bridging the gap between patient concerns and professional medical consultation.

1.5 RESEARCH SCOPE

The research scope of a Medibot project generally centers on developing AI-powered, conversational agents (chatbots) or robotic systems designed to improve healthcare accessibility, preliminary diagnosis, and administrative efficiency.

2. LITERATURE SURVEY

*****Automated Medical Chatbot" by Krishnendu Rarhi, Abhisek Bhattacharya et al, posted on 2018.

Medical care is vital to having a decent existence. Be that as it may, it is undeniably challenging to get an appointment with a specialist for each medical issue and due to the current global pandemic in the form of Coronavirus, the healthcare industry is under immense pressure to meet the ends of patients' needs. To resolve this problem, we have made a chatbot utilizing Artificial Intelligence (AI) that can analyze the illness and give fundamental insights regarding the infection by looking at the data of a patient who was previously counselled at a health specialist This will also assist in lessening the medical services costs. The chatbot is a product application intended to recreate discussions with human clients through intuitive and customized content. It is in many cases portrayed as the most moving and promising articulations of communication among people and machines utilizing Artificial Intelligence and Natural Language Processing (NLP). The chatbot stores the information in the data set to recognize the sentence and pursue an inquiry choice and answer the corresponding inquiry. Through this paper, we aim to create a fully functional chatbot that will help the patients/users to know about the disease by simply entering the symptoms they possess.

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*Medical Chatbot for Disease Prediction using Machine Learning" by Mrs. Asha Rani K P (2021), Ashish Zagade et al. (2024),

Healthcare systems are the widely used , by which a patient and people gets medical help, check-ups, disease understanding and issue and resolving it by using NLP and machine learning to create a chatbot system for healthcare. People can interact with the chatbot same as they communicate with other people. Chatbot system will detect the symptoms of the user and predicts the disease and recommends treatment for patient. This chatbot can be used for people in conducting daily follow up and makes people get to know about their problem and health issue. using this proposed architecture system can help people to detect the disease based on their symptoms and get predicted diagnosis and if user want get that medicine than they can get that through automatic order booking and get medicine through nearest pharmacy shop.

*"Self-Diagnosing Health Care Chatbot using Machine Learning", P Velmurgadass et al. (2024)

To lead a good and healthy life healthcare is extremely much important. It is very difficult to get the consultation with the doctor in case of any health issues. The proposed idea is to make a medical chatbot using AI which will diagnose the disease and supply basic details about the disease before consulting a doctor. to scale back the healthcare costs and improve accessibility to medical knowledge the medical chatbot is made. Few chatbots acts as reference books, which helps the patient find out about the illness and assists with improving their wellbeing. The user is able to do the important advantage of a chatbot only it can diagnose all quite disease and supply necessary information. A text-to-text diagnosis bot connects patients about their medical issues and gives a customized diagnosis to support their symptoms. Hence, people will have a thought about their health and have the proper protection.

**"A Personalized Medical Assistant Chatbot: MediBot", by G.P. KC, et al.

In the present scenario when most of the things are just a click away, people consider visiting hospitals as the most effective, reliable, and convenient way for their routine check-ups or disease diagnosis. In the past few years, Machine Learning has been playing a major role in the domain of healthcare. The proposed system or approach focuses on creating an alternate using Decision Tree Algorithm where people can interact with chatbot and it will identify other symptoms and predict the disease along with the confidence level and thus recommending a specialized doctor. Using the above framework can help people save their time and money as well.

*"Emergency Patient Care System using Chatbot" by Gowni Sushma, Ashok Kumar Bathula et al [07, March 2023]

With increasing cases of covid-19 and seasonal diseases it is found that pre-booking bed at hospital is difficult. And this leads to improper treatment on time. This system will come up with a medical chatbot. Chatbots are computer programs that communicate with users using NLP technique. The chatbot stores the information into a database to identify and process the keywords from the sentences. This AI based medical chatbot can take decisions as per the request of the user by using its database. Through chatbot one can speak with a text interface and get answers through AI. In the system, there will be focus on building a chatbot which can easily recommend nearby hospitals and can also provide bed booking facility, nearby vaccination centers and doctor's appointments. The functioning of medical chat-bots depends on Natural language processing. Many experts and doctors across the globe believe that getting a COVID-19 vaccine helps us keep safe from getting serious illness even if you get affected by COVID positive patient. After getting vaccinated, it will protect other people around, and can save lives as well as reduce risk.

**"Study of Machine Learning Algorithms for Special Disease Prediction using Principal of Component Analysis", by Dhomse Kanchan B and Mahale Kishor M published on 2016.

The worldwide study on causes of death due to heart disease/syndrome has been observed that it is the major cause of death. If recent trends are allowed to continue, 23.6 million people will die from heart disease in coming 2030. The healthcare industry collects large amounts of heart disease data which unfortunately are not "mined" to discover hidden information for effective decision making. In this paper, study of PCA has been done which finds the minimum number of attributes required to enhance the precision of various supervised machine learning algorithms. The purpose of this research is to study supervised machine learning algorithms to predict heart disease. Data mining has number of important techniques like categorization, preprocessing. Diabetic is a life threatening disease which prevent in several urbanized as well as emergent countries like India. The data categorization is diabetic patients datasets which is developed by collecting data from hospital repository consists of 1865 instances with dissimilar attributes. The examples in the dataset are two categories of blood tests, urine tests. In this research paper we discuss a variety of algorithm approaches of data mining that have been utilized for diabetic disease prediction. Data mining is a well known practice used by health organizations for classification of diseases such as diabetes and cancer in bioinformatics research.

*"Deep Learning using Rectified Linear Units (ReLU)" by Abien Fred Agarap published in 2018.

We introduce the use of rectified linear units (ReLU) as the classification function in a deep neural network (DNN). Conventionally, ReLU is used as an activation function in DNNs, with SoftMax function as their classification function. However, there have been several studies on using a classification function other than SoftMax and this study is an addition to those. We accomplish this by taking the activation of the penultimate layer $h_{n - 1}$ in a neural network, then multiply it by weight parameters θ to get the raw scores o_{i}. Afterwards, we threshold the raw scores o_{i} by 0, i.e. $f(o) = \max(0, o_{i})$, where $f(o)$ is the ReLU function. We provide class

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predictions $\hat{y}$ through argmax function, i.e. argmax $f(x)$.

*"Activation Functions: Comparison of Trends in Practice and Research for Deep Learning" by Winifred Ijomah et al. in 2018

Deep neural networks have been successfully used in diverse emerging domains to solve real world complex problems with may more deep learning(DL) architectures, being developed to date. To achieve these state-of-the-art performances, the DL architectures use activation functions (AFs), to perform diverse computations between the hidden layers and the output layers of any given DL architecture. This paper presents a survey on the existing AFs used in deep learning applications and highlights the recent trends in the use of the activation functions for deep learning applications. The novelty of this paper is that it compiles majority of the AFs used in DL and outlines the current trends in the applications and usage of these functions in practical deep learning deployments against the state-of-the-art research results. This compilation will aid in making effective decisions in the choice of the most suitable and appropriate activation function for any given application, ready for deployment. This paper is timely because most research papers on AF highlights similar works and results while this paper will be the first, to compile the trends in AF applications in practice against the research results from literature.

3. FEASIBILITY STUDY

A feasibility study assesses the operational, technical and economic merits of the proposed project. The feasibility study is intended to be a preliminary review of the facts to see if it is worthy of proceeding to the analysis phase. The objective of a feasibility study is to find out if an information system project can be done and to suggest possible alternative solutions. Based on a feasibility study, an AI-Driven Medical Chatbot for Interactive Diagnostics is highly feasible for offering strong potential to bridge healthcare gaps, though it requires addressing critical accuracy and security hurdles. The market for conversational AI in healthcare is projected to experience substantial growth, with significant savings projected through automation.

TECHNICAL FEASIBILITY

A large part of determining resources has to do with assessing technical feasibility. It considers the technical requirements of the proposed project.The system can be developed using advanced Natural Language Processing (NLP) to interpret symptoms, combined with machine learning algorithms like SVM (Support Vector Machine), LSTM (Long Short-Term Memory), to suggest potential conditions. Research indicates that AI chatbots can achieve high diagnostic accuracy (up to 96-97%) for common illnesses, often performing faster than human consultation (~1.8 seconds). Ensuring high accuracy in distinguishing between minor and severe and complex symptoms.

OPERATIONAL FEASIBILITY

Operational feasibility is dependent on human resources available for the project and involves projecting whether the system will be used if it is developed and implemented. Chatbots can be integrated into existing healthcare workflows to handle preliminary screening and triage, freeing up time for doctors. User's Surveys show high willingness (over 80%) to use chatbots for minor or non-urgent symptoms.The accessibility can be 24/7 availability enables patient engagement, particularly after-hours, with high engagement rates (~90%).Patients must trust the chatbot's diagnosis, requiring explainable AI (XAI) to be implemented for transparency. Need to support diverse, local languages for wider accessibility.

ECONOMIC FEASIBILITY

Economic analysis could also be referred to as cost/benefit analysis. It is the most frequently used method for evaluating the effectiveness of a new system. timeframe. The required timeframe would need to be set by the organization. AI chatbots are projected to save the global healthcare industry billions by decreasing the need for in-person appointments for minor illnesses. Healthcare facilities can see 25-50% costs reductions in administrative tasks (scheduling, triage). Studies indicate that AI diagnostics can offer a lower annual cost compared to traditional workflows, saving on unnecessary diagnostic tests.

4. METHODOLOGY & SYSTEM ARCHITECTURE

4.1 PROPOSED SYSTEM OVERVIEW

The proposed MediBot project is an AI-powered medical assistant designed to act as an intelligent intermediary between patients and healthcare services, providing preliminary diagnosis, medication management, and health information. It leverages Natural Language Processing (NLP), machine learning (ML), and sometimes IoT sensors to provide real-time, personalized healthcare guidance.

4.2 DATASET COLLECTION

The dataset provides the foundation for the model to understand the relationship between symptoms and diseases. Medical datasets are commonly gathered from public repositories such as Kaggle or Mendeley. Typical datasets composition includes over 246,000 rows, containing information for 773 unique diseases and 377 symptoms. Another common structure involves 40 diseases and 132 symptoms.

4.3 MODEL SELECTION STRATEGY

For Disease Prediction (Structured Data):

*__Decision Tree Classifier:__ Often chosen for high accuracy (~95%) and interpretability in predicting 40+ diseases based on 130+ symptoms.

*__K-Nearest Neighbors (KNN):__ Good for finding similar diseases based on symptom vectors (~92% accuracy).

*__Random Forest / Gradient Boosting:__ Recommended to increase accuracy by reducing overfitting.

4.4 HARDWARE REQUIREMENTS: CPU-Intel Core i5/AMD Ryzen 5

GPU-Minimum (Lightweight NVIDIA RTX 3060 (12GB VRAM).

Memory (RAM)-16GB.

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Storage-Minimum: 256GB SSD.
Networking-10Gbps.

4.5 SOFTWARE REQUIREMENTS:

Operating System- Windows 11
Frameworks-Python, TensorFlow
Backend-Flask for building the API endpoints.
Frontend- Angular/React (Virtual)
Databases-PostgreSQL, MongoDB

5. IMPLEMENTATION & RESULTS

AI-driven medical chatbots for interactive diagnostics are transforming healthcare by leveraging Natural Language Processing (NLP) and machine learning (ML) to provide 24/7 symptom analysis, preliminary disease prediction, and triaging. Implementation generally involves training models on medical datasets to interpret user symptoms, while results demonstrate high user satisfaction and significant potential in reducing the burden on primary healthcare systems.

5.1 KEY IMPLEMENTATION & TECHNOLOGIES

***MediChat AI:** Uses the transformer model for query responses and Random Forest for diagnosis.
***Livi (UCHealth):** AI integrated with smart speakers for finding doctors and health information.
***Hybrid Model:** An ensemble learning approach using KNN, AdaBoost, and MLP achieving high accuracy.
***MedEase:** Uses LLMs, Langchain, and vector searching for RAG.

5.2 RESULTS AND PERFORMANCE

***High Diagnostic Accuracy:** Studies show that AI chatbots can achieve up to 96.47% accuracy in identifying potential conditions in experimental settings.
***User Satisfaction:** Implementations frequently report high user satisfaction, with one study showing a mean score of 4.65 out of 5 for accuracy, functionality, and compatibility.
***Efficiency Gains:** A study on a "Medibot" chatbot showed a reduction in unnecessary doctor visits by aiding in early triage and improving the speed of medical assessments.
***Multimodal Capabilities:** Advanced chatbots like IOMIDS (Intelligent Ophthalmic Multimodal Interactive Diagnostic System) have shown strong performance (up to 81.1% accuracy) when combining text and image input.
***Impact on Workload:** Research indicates AI chatbots can save the healthcare industry $3.6 billion globally by 2025 by optimizing workflows, handling routine queries, and managing appointments.

Figure 1: Home Page of Medibot



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Figure 2: Admin Portal of Medibot

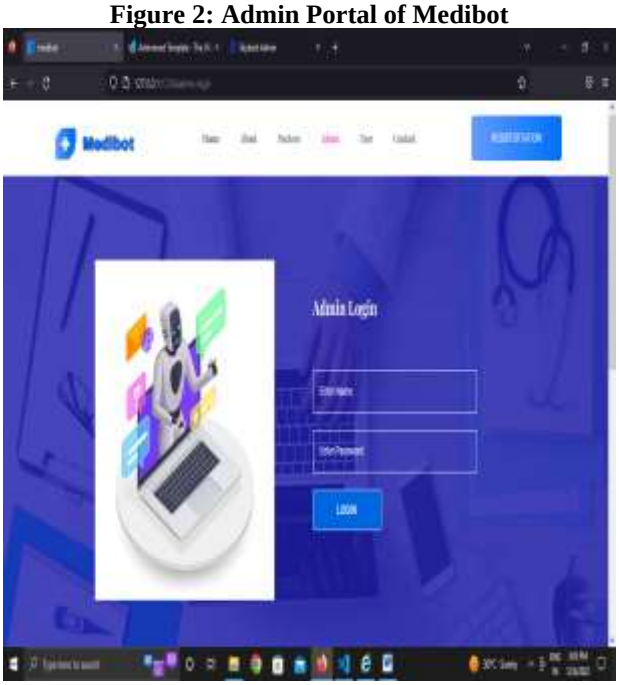


Figure 3: Admin Portal Accessibility.

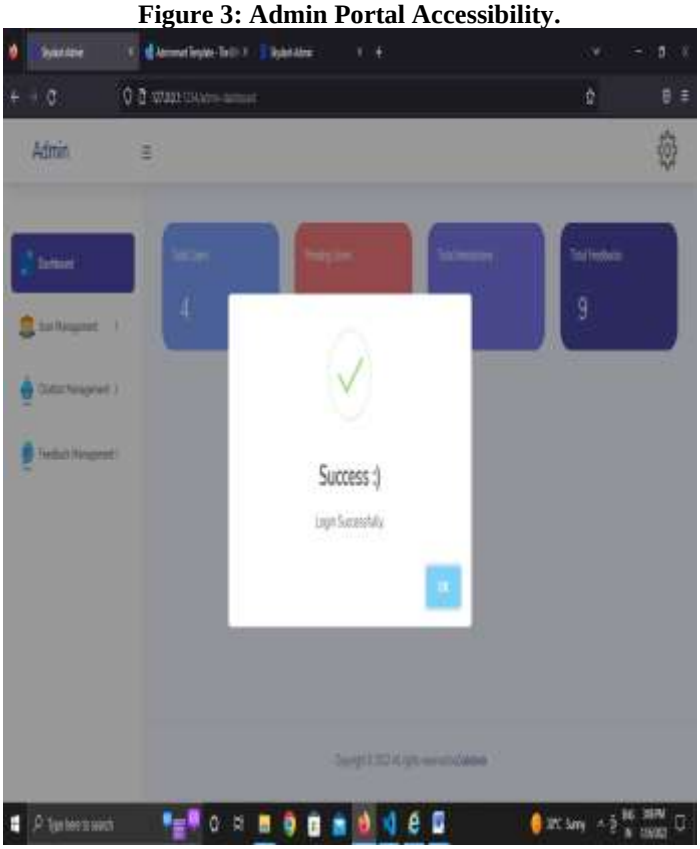


Figure 4: Admin Chatbot Management

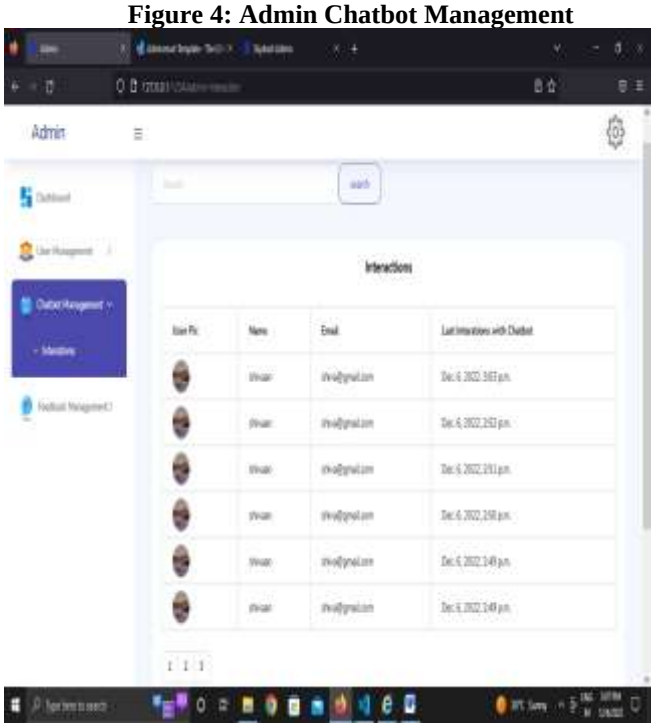
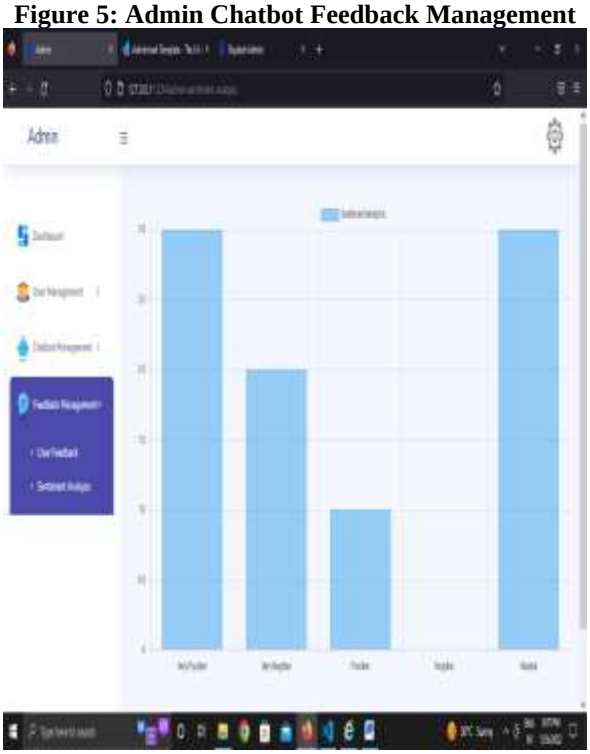


Figure 5: Admin Chatbot Feedback Management



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Figure 6: User's Portal

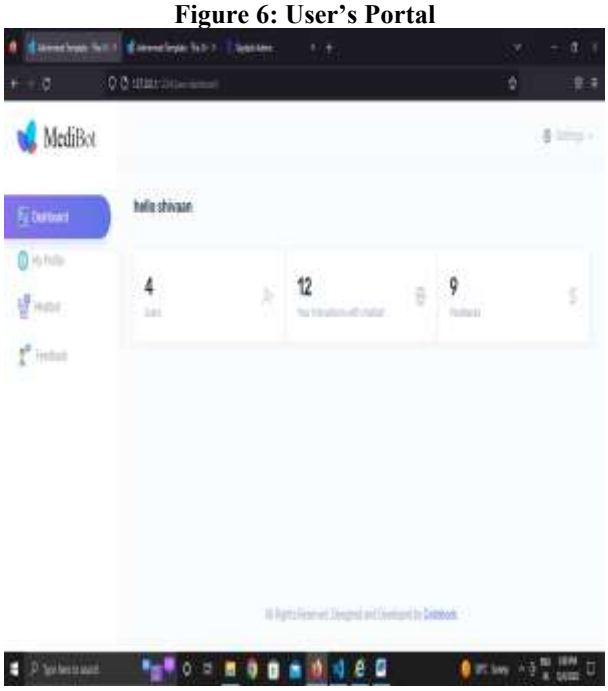
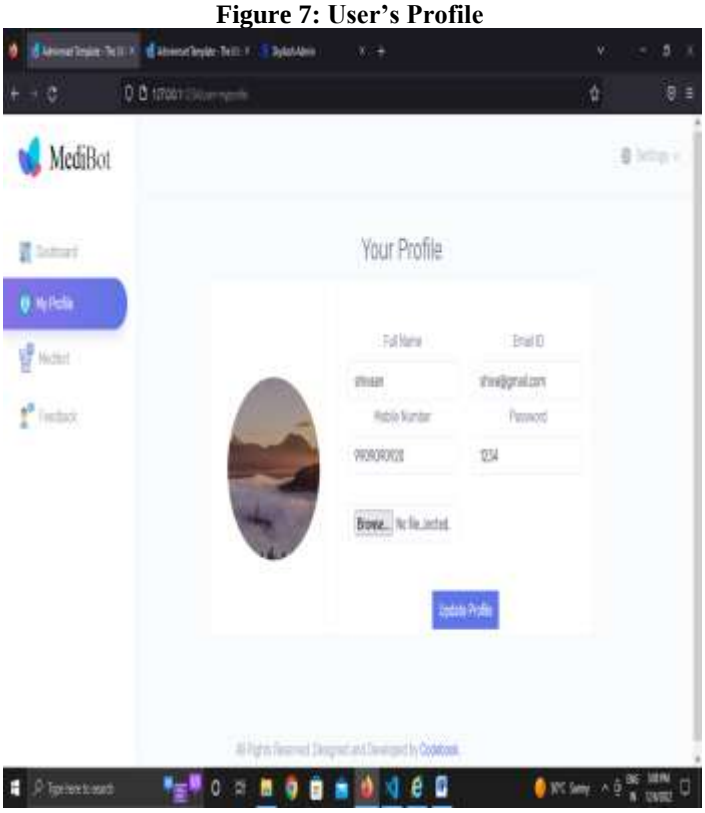


Figure 7: User's Profile



6. CONCLUSION

In this paper, we have implemented a system for the patients which will have great impact in their life. It would provide the users an advantage of carrying virtual doctor with them. It would also give them a freedom to check the current status of their health 24/7. This can turn out to be one of the most popular tools among the people having a busy schedule. This system can also be useful to the elderly and physically disabled people as they can get information about their minor health issues at their fingertips. The implemented system also provides an option to download the results generated by chatbot which can be further used when consulting a doctor. The users can also take advantage of this application as all the data is kept online and therefore provides a real time experience to them.

7. FUTURE ENHANCEMENT

AI-driven medical chatbots are evolving from basic symptom checkers into sophisticated, interactive diagnostic tools that offer 24/7, personalized medical assistance. Future enhancements focus on increasing diagnostic accuracy, enhancing user trust through transparency, and integrating multimodal data for a more holistic view of patient health.

*__Multimodal Data Analysis (Imaging and Documents):__ Future chatbots will move beyond text, incorporating Advanced OCR capabilities to interpret medical documents, including CT scans, ECG charts, and blood pressure graphs. This allows for the analysis of both structured and unstructured visual and textual health data.

*__Explainable AI (XAI) for Transparency:__ To increase trust, future systems will focus on explainable models that can justify their diagnostic suggestions, rather than acting as a "black box".

__*Real-Time Physiological Monitoring Integration:__ Integration with wearables and sensors will enable chatbots to analyze real-time data, such as eye movement, facial expressions, and heart rate, to identify patterns and provide early warnings.

*__Proactive Personalized Health Management:__ Moving from reactive diagnostics, chatbots will offer personalized, proactive health management, such as custom diet, workout plans, and chronic disease management.

__*Telemedicine and Clinical Integration:__ Advanced chatbots will integrate directly with EHR systems to provide clinicians with summarized patient notes, reducing administrative burdens, and facilitating seamless handoffs to human doctors for immediate care.

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