Personalized-Healthcare and Medicine Recommendation System Using Machine Learning

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Abstract: Digital solutions have emerged in recent years that improve patient care and diagnostic efficiency as a result of the healthcare industry's integration of intelligent technologies and machine learning. Through the analysis of user-reported symptoms, this project presents an intelligent, web-based health assistant that employs machine learning techniques to identify possible diseases. The system provides individualized treatment recommendations, including prescription drugs, diets, physical activity, and appropriate safety measures, in addition to basic diagnostics. Incorporating Support Vector Machine (SVM) models that have been trained on structured datasets of symptoms and diseases guarantees real-time forecasts and recommendations that are based on confidence. Users, physicians, and administrators can access it based on their roles, and an interactive dashboard is available to track activities. The system's objectives are to lessen the diagnostic burden on healthcare facilities, empower proactive healthcare decisions, and improve accessibility.

Keywords**:** *Disease Prediction, Machine Learning, Personalized Advice, Suggestions, Symptoms, Appointments.*

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I. INTRODUCTION

The suggested system functions as an intelligent medical assistant that lets users enter symptoms and get information about possible illnesses. It uses symptom mapping and artificial intelligence to provide precise disease predictions and personalized treatment recommendation recommendations. The method helps users manage their health on their own by focusing on self-awareness and early intervention.

To enhance predictive performance, it integrates a Support Vector Machine (SVM) model that uses One-Vs-Rest categorization.

The system, which was developed with a responsive HTML/JavaScript frontend and the Flask framework on the backend, guarantees smooth interaction and accessibility for a wide range of user roles.

In order to provide holistic health support, the model's extensive dataset include symptoms, treatments, and wellness recommendations.

II. RELATED WORKS

- A machine learning-based nutrition recommendation system that makes use of k-NN, SVM, and neural networks was proposed by Marouane Fethi Ferjani. With an accuracy of 87.5% using neural networks, 82.3% using support vector machines, and 78.9% using k-NN, this system customizes meal plans depending on user data. Precision, recall, and F1-score are included in the performance evaluation, which shows how well the system provides adaptive dietary recommendations.
- Using a meal suggestion strategy that uses a variant of the Ant Colony Optimization (ACO) algorithm on a food graph, Faisal Rehman et al. investigated a novel approach to food recommendations. The Diet-Right method makes use of ACO, a population-based, constructive approach that was motivated by ant behavior and is well-known for solving combinatorial optimization issues. When 110 ants were used in the algorithm, it demonstrated an astonishing 97% accuracy in tests involving 3,400 food items and 345 medical reports. When compared to a single-computer setup, the system was 12 times faster thanks to cloud-based processing. According to the findings, Diet-Right is scalable and successful in providing individualized dietary advice.
- PREMIER, a graph-based drug recommendation system, was introduced by Suman Bhoi. The purpose of this method is to use electronic health records (EHRs) to customize medications.

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- An app called PERSON, a Genetic Algorithm-based Personalized Nutrition System, was created by a Chinese researcher. Based on genetic information, this system combines deep learning and genetic algorithms to provide tailored supermarket product recommendations.

- Using interconnected Recurrent Neural Networks (RNNs), Arash Golibagh Mahyari demonstrated an exercise suggestion system that forecasts workout success rates. Using exogenous data and exercise embedding as inputs, the model's two interconnected RNNs produce recommendations for exercise activities and their success rates.

- Using information from Food Frequency Questionnaires (FFQs), Rodrigo Zenun Franco created the E-Nutri System, a customized online nutrition guidance tool that offers dietary recommendations based on AHEI ratings. 163 participants provided positive feedback on the system's acceptance and use.

III. METHODOLOGY

A web-based tool called the AI-driven Health Recommender uses machine learning to evaluate symptoms submitted by users and provide tailored health recommendations. In order to interact, users input their symptoms into a straightforward and user-friendly interface. A Flask-based backend application processes these inputs and uses a trained machine learning model to forecast possible illnesses.

Following the identification of a condition, the system retrieves pertinent data from a structured database, including prescription drug recommendations, food guidance, exercise regimens, and preventative actions. After that, the findings are shown in an understandable manner, enabling people to make wise healthcare choices.

A. Machine Learning Algorithms Used:

- *Support Vector Machine (SVM):*

SVM is a potent classification method that uses symptom patterns to determine the best decision border between classes in order to identify diseases. When it comes to multi-class classification tasks, such as disease prediction, it works very well.

- *K-Nearest Neighbours (KNN):*

In order to find similar cases, KNN compares the user's symptoms with those of previous cases. It uses the Euclidean distance calculation to suggest therapies, including medication, based on these "neighbors."

- *Gradient Boosting:*

An ensemble learning method called gradient boosting constructs several weak learners—typically decision trees—sequentially. In order to gradually increase overall accuracy, each new model attempts to fix the forecast errors caused by the ones that came before it. In order to increase overall forecast accuracy, each succeeding model concentrates on fixing the mistakes produced by the one before it. Although useful for diagnosing conditions, it can be computationally taxing.

- *Random Forest:*

Multiple decision trees are used in Random Forest, an ensemble classifier, to increase prediction accuracy and decrease overfitting. It is a dependable option for illness detection because to its stability and resilience.

- *Multinomial Naïve Bayes:*

A probabilistic model that works well with categorical data, such as labels for diseases and symptoms. Based on the input symptoms, it determines the probability of each condition and chooses the most likely one. It is nevertheless useful in many medical situations even if it makes the unrealistic assumption that features are independent.

B. Flask Framework

A Python web framework that is lightweight and perfect for creating scalable web apps is called Flask. It makes it simpler to create and maintain dynamic web applications by providing essential features like HTML template, URL routing, and HTTP request processing. A pleasant and responsive user experience is ensured in this system using Flask, which makes it easier for the user interface and the backend machine learning model to communicate.

- *Dataset Description*

The system makes use of binary-valued datasets, in which 1s and 0s stand in for entries (1 = present, 0 = missing). These datasets relate particular diseases to symptoms, preventative measures, diets, exercises, and treatments. There are 41 diseases covered in all, and since each one has several symptoms, disease prediction is made reliable and effective.

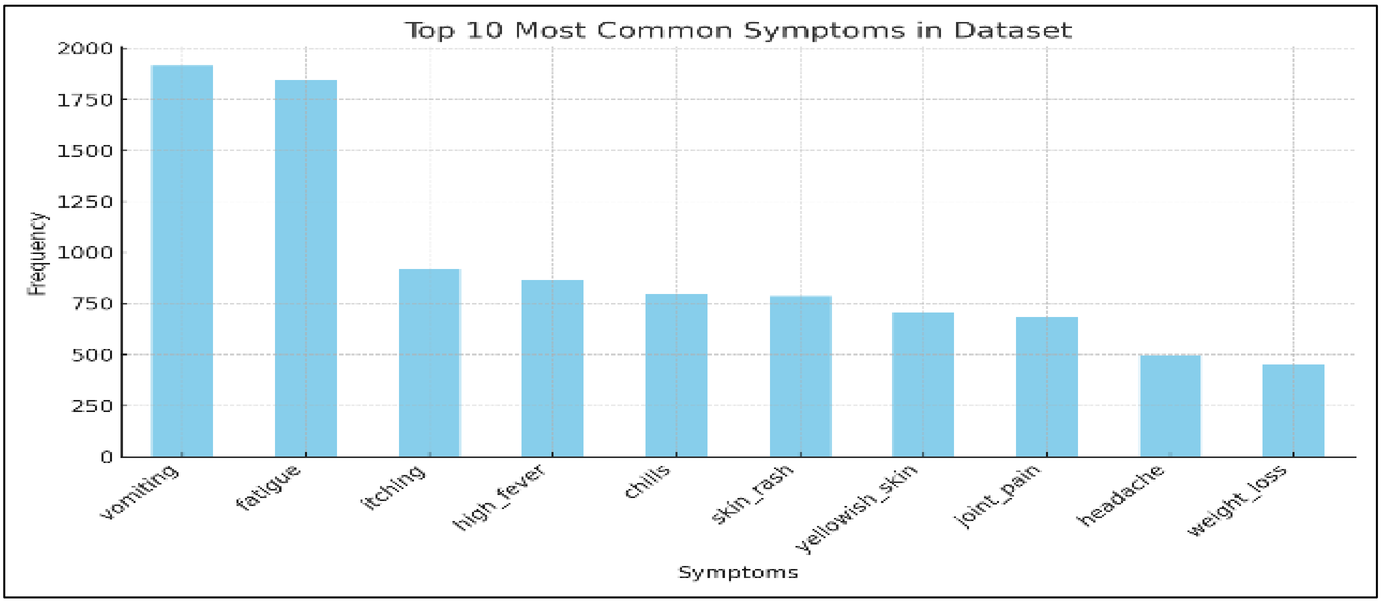

Fig1Top 10 Most Common Symptoms in the Dataset

The Top 10 Most Common Symptoms in the dataset are shown in Figure 1. These common symptoms, which include headache, nausea, vomiting, and exhaustion, serve as the basis for diagnosing different illnesses in the body. Their significance as crucial markers for early diagnosis is shown by their great frequency. The system can increase the accuracy of suggestions by prioritizing likely conditions during prediction by examining patterns of symptom incidence.

These symptoms serve as the machine learning model's main input features, especially for the system's Support Vector Machine (SVM) classifier. The model determines the most likely disease outcome by comparing the symptoms entered by users with learning patterns. In order to provide a thorough and individualized healthcare solution, the system further maps the projected disease to pertinent datasets, offering descriptions, suggested drugs, nutritional advice, and preventative actions.

C. Workflow

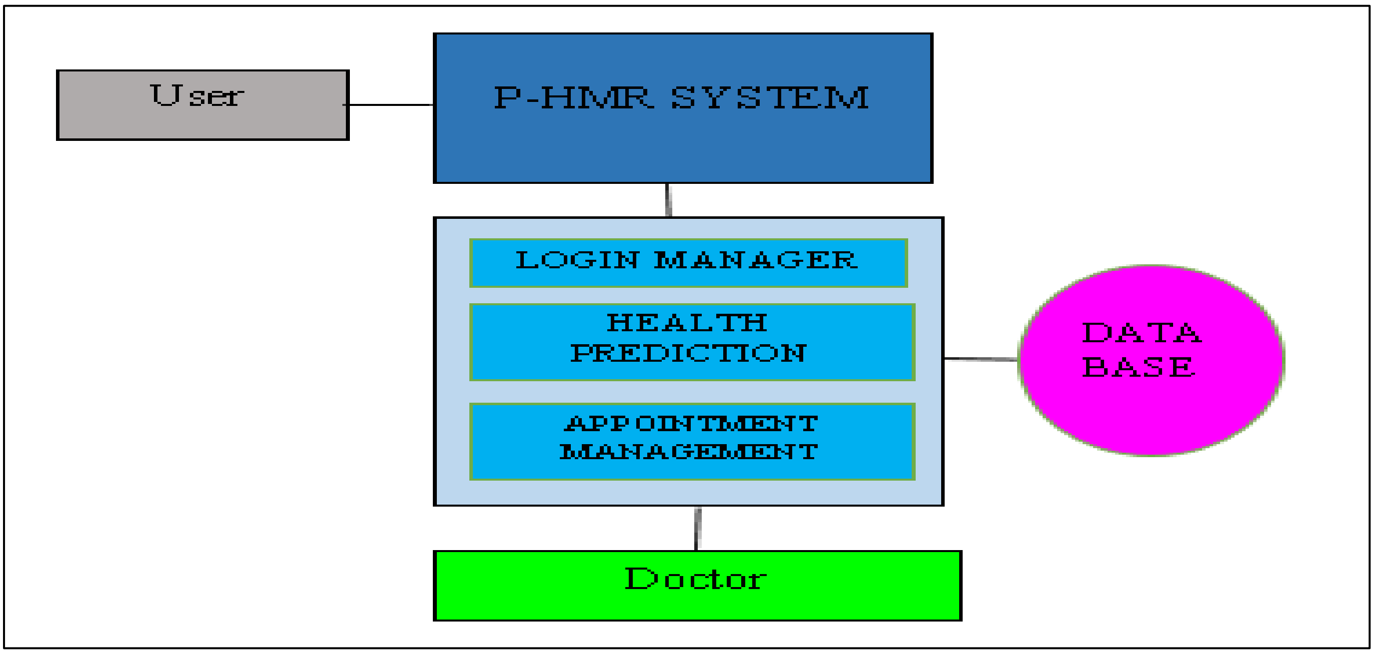

Fig 2 Flow Diagram of the System

A flow diagram for a health recommender system is shown in Figure 2. To determine the most likely disease, the user first enters symptoms through the interface, which are subsequently processed by a machine learning model (SVM classifier). After identifying the illness, the system consults pertinent databases to provide tailored suggestions for drugs,

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diets, exercises, and safety measures. The frontend shows the user the findings, while the backend manages data flow and prediction algorithms. A comprehensive and interactive healthcare solution is ensured by the admin and doctor positions' login choices, which enable them to manage data, view history, and help with diagnosis.

IV. RESULT AND DISCUSSION

The Support Vector Machine (SVM) with a One-Vs-Rest (OVR) classifier is one of the machine learning approaches that have been successfully used to create the suggested Symptom-Based Health Recommender System. Based on symptoms entered by the user, this system forecasts illnesses. A dataset comprising 41 different diseases, their symptoms, descriptions, safety measures, nutrition advice, exercise regimens, and prescription recommendations was used to train it.

Fig 3 Training Vs. Validation Accuracy Over Epochs

Figure 3 Shows The line graph shows the model's performance over 10 epochs in terms of training and validation accuracy. From 72% to 94%, the training accuracy grows consistently, and from 70% to 90%, the validation accuracy increases similarly. This steady improvement in both curves shows that the model is learning efficiently and not overfitting, demonstrating a strong capacity for generalization in the prediction of diseases based on symptoms.

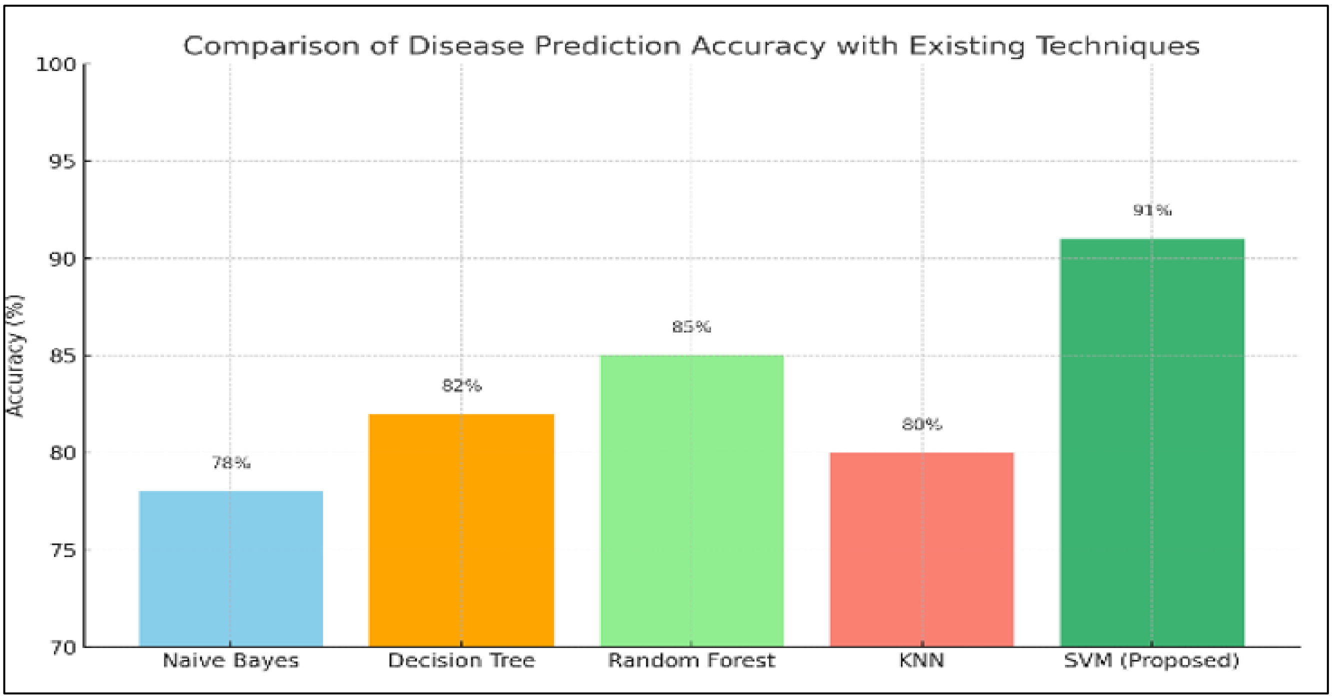

Fig 4 Comparison of Disease Prediction Accuracy with Existing Techniques

A bar graph comparing the accuracy of various machine learning algorithms for disease prediction is shown in Figure 4. Accuracy ranges from 78% to 85% for Naive Bayes, Decision Tree, K-Nearest Neighbors (KNN), and Random Forest. In comparison, the suggested system's Support Vector Machine (SVM) gets the greatest accuracy of 91%, demonstrating its efficacy and superior performance in this context of healthcare suggestion.

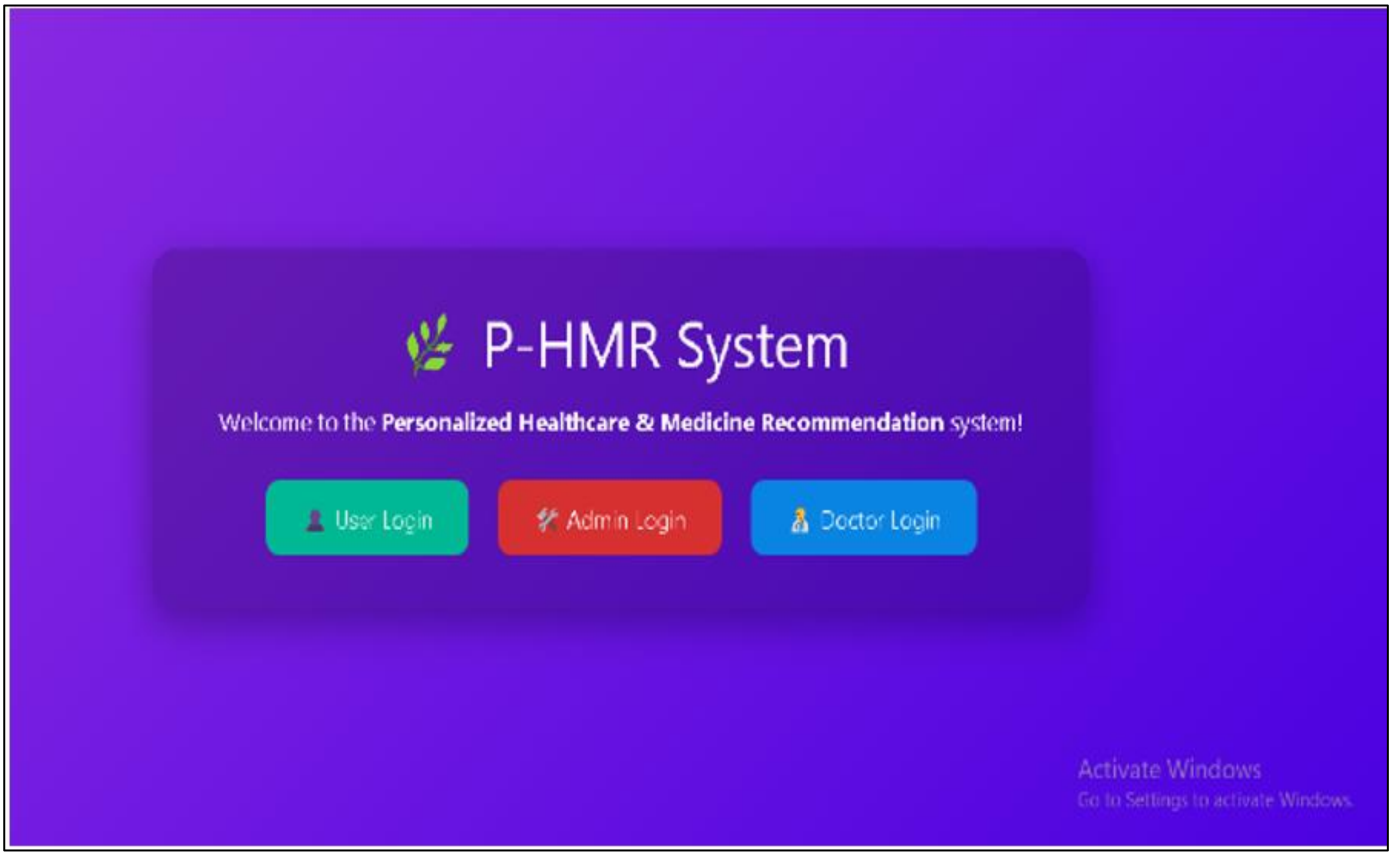

Fig 5 Home Page

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The homepage of the P-HMR System (Personalized Healthcare & Medicine Recommendation System) is shown in Figure 5. It has a centered login panel, a purple background, and an easy-to-use interface. A statement outlining the system's mission to provide individualized medical care and medication suggestions greets users. Patients can receive predictions and ideas through the User Login, system administrators can manage and keep an eye on the platform through the Admin Login, and medical professionals can read patient reports and offer expert feedback with the Doctor Login. Role-based access guarantees safe and customized interaction for every kind of user.

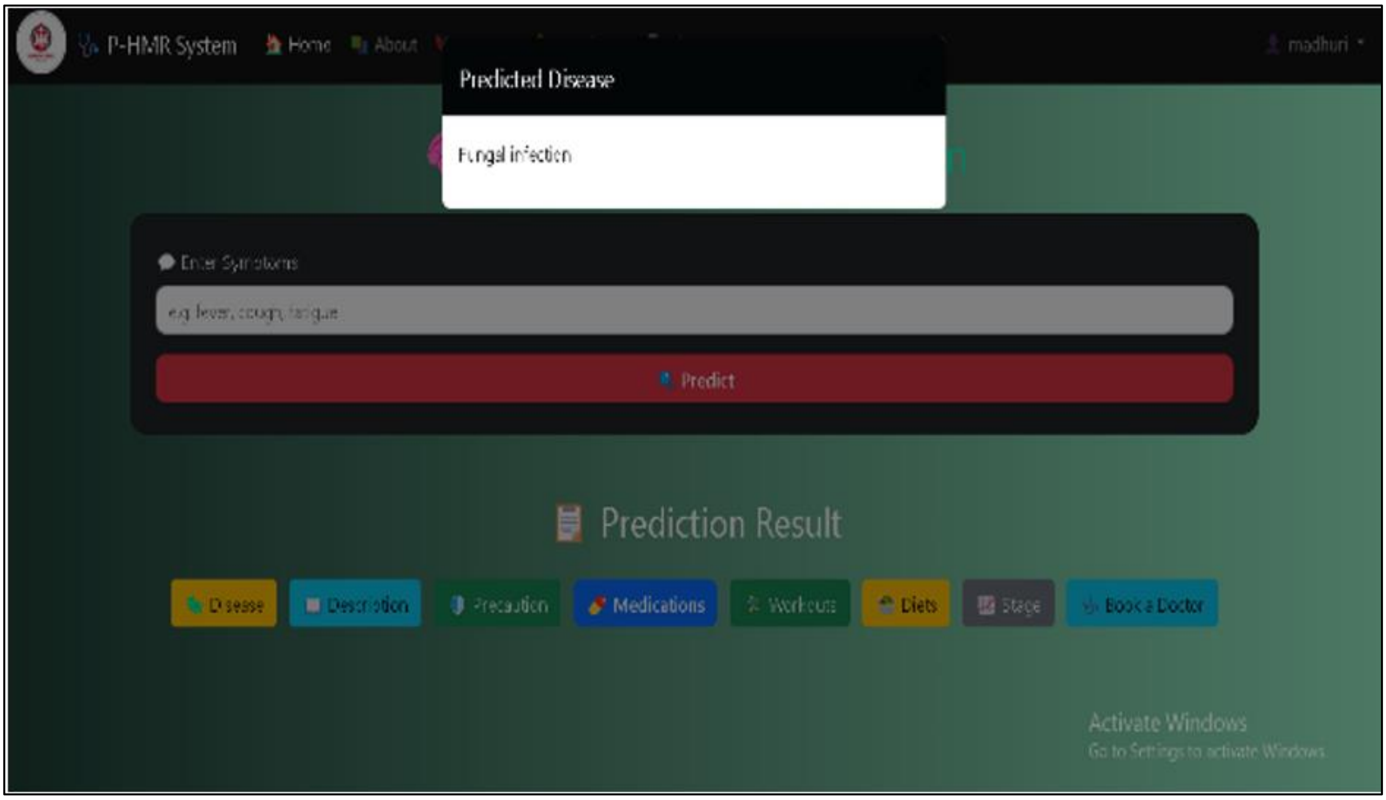

Fig. 6 User Disease Prediction Page

Users can enter symptoms like "fever, cough, fatigue" into a text field and click the red Predict button to receive diagnostic insights on the P-HMR System's AI-Based Health Prediction site, as shown in Figure 6. After a prediction is generated, the system creates a thorough Prediction Result section with several clickable buttons for detailed outputs, including the following: Stage, Medications, Workouts, Diets, Disease, Description, Precaution, and the ability to Book a Doctor. Users can effectively receive individualized healthcare advice based on their symptoms thanks to this interactive and aesthetically pleasing interface.

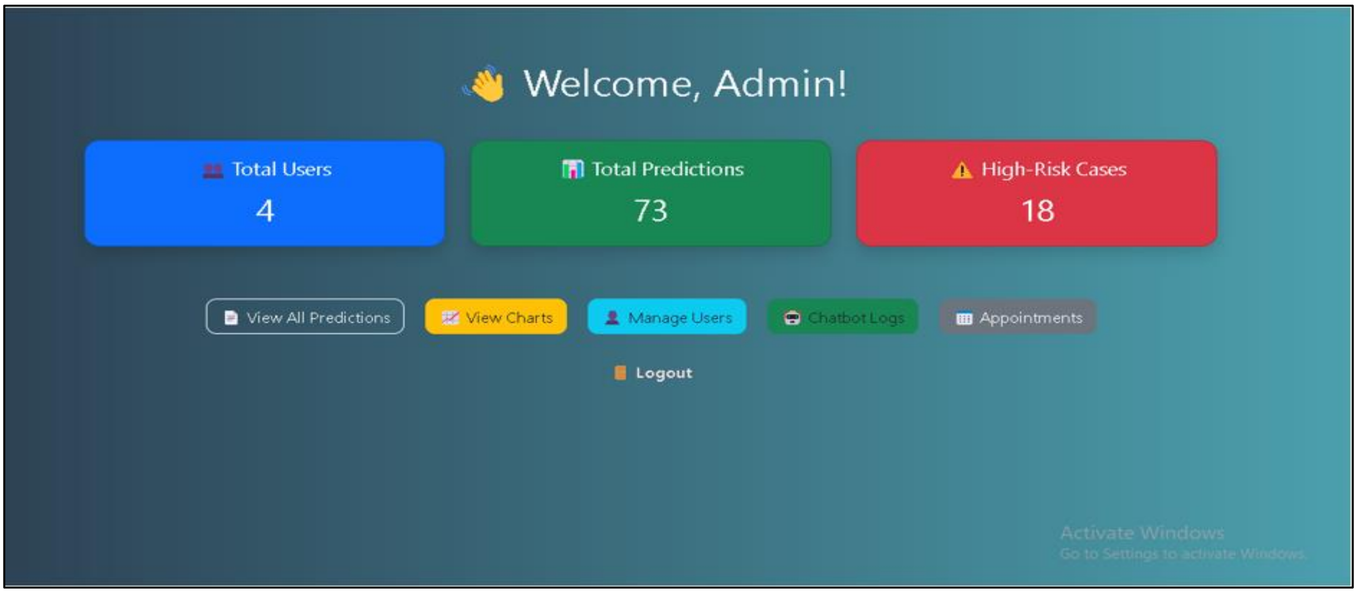

Fig 7 Admin page

Figure 7 shows the P-HMR System's Admin Dashboard, which greets the administrator and provides a summary of system data. It displays 61 total forecasts, 4 users, and 16 high-risk cases. Action buttons beneath the statistics provide the administrator access to charts, all predictions, user management, chatbot logs, and appointments. Additionally, a Logout button is included to guarantee a safe escape. The dashboard provides a single, intuitive interface for efficiently controlling and keeping an eye on the health recommendation system.

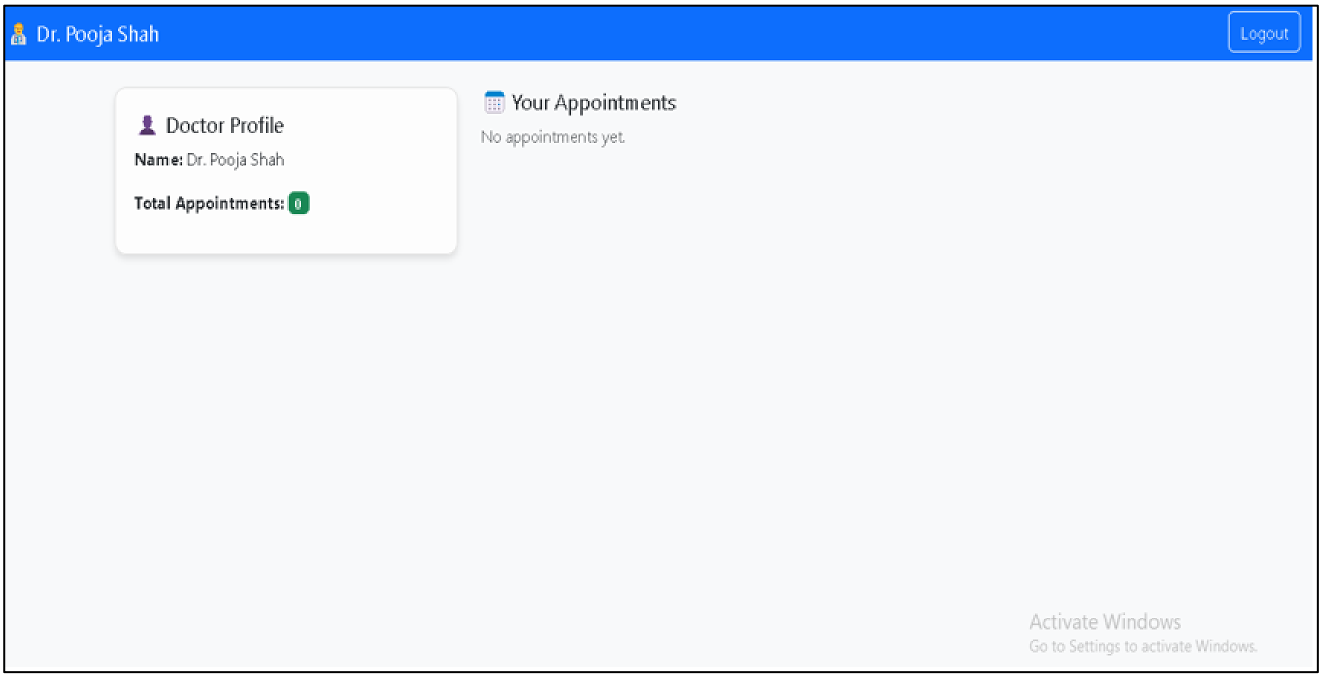

Fig 8 Doctor Page

The image that shows Dr. Amit Iyer's Doctor Dashboard in the P-HMR System is shown in Figure 8. The profile of the doctor is displayed, with a total of one appointment noted. The "Your Appointments" column on the right displays a searchable table with the patient's information, including name (Madhuri), email address (mad@gmail.com), diagnosed condition (fungal infection), and time and date of booking (2025-07-28 16:31:43). Doctors can effectively schedule and manage patient visits with this interface.

V. CONCLUSION

In conclusion, the Personalized Healthcare & Medicine Recommendation (P-HMR) System successfully integrates machine learning with an intuitive web interface to help people identify potential diseases based on symptoms and receive personalized medical recommendations by offering a quick, accessible, and incredibly accurate illness prediction platform. The technology provides quick and precise health

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insights by combining Support Vector Machine (SVM) classification with comprehensive datasets that span descriptions, prescriptions, diets, precautions, and workouts. Furthermore, adding distinct logins for administrators, doctors, and users improves usability, security, and functionality. This study shows how artificial intelligence (AI) may improve healthcare accessibility, proactivity, and personalization, ultimately enabling patients to take charge of their health and allowing medical professionals to provide data-driven advice.

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