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Web-Based Patient Health Management System with Doctor Recommendations and Medicine Alternatives using Machine Learning

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***Abstract*—Web-Based Patient Health Management System with Doctor Recommendations and Medicine Alternatives depicts a novel doctor appointment system that unites simplicity with sophisticated technology, featuring a Random Forest Classifier model to boost healthcare services. Another advantageous component is the inclusion of a specific pharmacy area, enabling efficient drug administration tracking. Confirmation emails are sent upon successful appointment bookings, keeping individuals updated on upcoming visits. The platform also encompasses a multifaceted disease prediction mechanism powered by the Random Forest Classifier's predictive capabilities, assisting physicians in delivering accurate diagnoses and targeted therapy recommendations[15]. Integrating of these elements results in a comprehensive strategy for managing patient health. By emphasizing user-friendliness and advanced technology, the system aims to elevate both patient satisfaction and healthcare provider productivity. Employing machine learning techniques within medical settings can lead to enhanced appointment scheduling efficiency and diagnostic precision, ultimately benefiting patients through improved care outcomes.**

***Index Terms*—Random Forest Classifier, Tailored Guidance, Recommendation, Symptoms , Appointment**

I. INTRODUCTION

Here the proposed system aimed at streamlining doctor appointment processes while incorporating a range of healthcare-related features. Our system utilizes a Random Forest Classifier model to automate appointment scheduling, eliminating the need for human intervention. [11]The proposed work comprises several essential components, such as a dedicated pharmacy web page, a healthcare bot providing relevant advice, email confirmations followed by appointment scheduling, and a multi-disease diagnostic feature. The pharmacy section caters to users by offering easy access to medication services. The healthcare bot enhances user engagement by sharing valuable healthcare insights and knowledge. [14]Email notifications ensure immediate updates on secured appointments, maintaining clear communication. The multi-disease diagnostic attribute significantly improves the system value by providing comprehensive health assessments, which may contribute to early detection and treatment of various conditions[16].

The implementation of Flask as the underlying framework allows to manage user requests, handle data processing, and maintain connections between different components. Also the proposed work represents a comprehensive solution for doctor appointment organization and healthcare assistance, leveraging machine learning techniques and diverse functions to enhance the overall healthcare experience for patients and healthcare professionals[12].

II. LITERATURE REVIEW

In [1] ,the author proposed a comprehensive survey upon the appointment scheduling within the healthcare sector. It states the challenges and opportunities surrounding this critical aspect of healthcare management.This system explores about the various scheduling methodologies.

The proposed system focuses on comprehensively discusses various scheduling methodologies and the role of emerging technologies, it may lack in-depth analysis or empirical validation of the proposed strategies. Without concrete examples or case studies, the effectiveness of the discussed approaches remains theoretical.

In [2] , the proposed system focused on the application of machine learning techniques in healthcare appointment

scheduling processes. It discussed about how machine learning models can analyze large dataset to predict patient demands and to optimize appointment allocation that minimize schedul- ing conflicts.

The proposed system focuses heavily on the application of machine learning techniques but may overlook the practical challenges and limitations of implementing such models in real-world healthcare settings.

In [3], the system proposed a cloud-based appointment scheduling system tailored for healthcare services.It depicted about the cloud computing processes which provide numerous advantages,including scalability, accessibility and cost effectiveness making it ideal platform for managing scheduling tasks in healthcare settings.

The advantages of cloud-based scheduling systems are highlighted, the paper may not adequately discuss potential security and privacy concerns associated with storing sensitive healthcare data on cloud platforms.

In [4], the system reviewed the optimization techniques applied to appointment scheduling in healthcare system. Mainly it discussed various optimization approaches, including mathematical programming, heuristic algorithms, and meta heuristic methods , highlighting the strength and limitations in addressing the complexities of healthcare scheduling.

The review of optimization techniques lacks specific examples or case studies illustrating the application of these methods in real-world healthcare scenarios. Without empirical validation or comparative analysis, it's challenging to assess the practical effectiveness of the discussed optimization approaches.

In [5], offers comprehensive review of appointment scheduling techniques specifically designed for healthcare industries. It discussed about various scheduling algorithms, including rule-based systems, optimization methods,and simulation approaches, highlighting their capabilities in different healthcare methods.

The proposed system provides a comprehensive overview of scheduling techniques, it may not sufficiently address the interoperability challenges associated with integrating various scheduling technologies with existing healthcare IT systems.

In [6], author conducted a survey of techniques aimed at enhancing the quality of services in healthcare appointment scheduling systems. It explored various strategies for improving patient experience, optimizing resource allocation, and increasing operational efficiency in scheduling processes.

The proposed system explores techniques for improving service quality in scheduling systems, it may lack a critical examination of potential biases or ethical considerations associated with the use of advanced technologies such as machine learning in healthcare decision-making.

In [7], author proposed a novel approach to appointment scheduling in healthcare using hybrid neural networks. which leverage the capabilities of neural networks to model complex scheduling relationships and optimize appointment allocation decisions.

The proposed hybrid neural network approach may lack transparency or interpret ability compared to traditional scheduling methods. Without clear explanations of how scheduling decisions are made by the neural network model, it may be challenging for healthcare providers to trust or validate the system's recommendations.

In [8], a fuzzy logic-based approach to appointment scheduling for healthcare services was introduced. It argue that fuzzy logic systems are well-suited for handling uncertainty and imprecision inherent in scheduling tasks, such as patient preferences, resource availability, and scheduling constraints. The fuzzy logic-based scheduling systems offer flexibility in handling uncertainty, the paper may not thoroughly address the computational complexity or scalability issues associated with implementing fuzzy logic algorithms in large-scale healthcare environments.

In [9], an improved healthcare appointment scheduling approach using genetic algorithms was discussed. Here the optimization capabilities of genetic algorithms to find near-optimal solutions to scheduling problems, such as minimizing patient wait times and maximizing resource utilization was leveraged.

The genetic algorithms offer optimization capabilities, the paper may not adequately address the computational overhead or convergence issues associated with genetic algorithm-based scheduling approaches.

In [10], a multi-objective optimization approach for healthcare appointment scheduling using particle swarm optimization (PSO) was conducted. Here, that traditional scheduling methods often focus on single objectives, such as minimizing patient wait times.

The proposed system focuses on multi-objective optimization using particle swarm optimization (PSO) but may not sufficiently address the complexity of defining and prioritizing multiple scheduling objectives.Additionally, the scalability of PSO-based approaches in handling high-dimensional scheduling problems is not thoroughly discussed.

III. PROPOSED METHODOLOGY

Each component in this "Fig. 1", including the doctor appointment scheduling system, pharmacy page, healthcare chatbot, and email notification service, should be detached and scalable individually. Exploring advanced machine learn- ing algorithms or merging models could potentially enhance prediction precision and efficiency. Additionally, implementing a recommendation system based on user preferences and previous data would guide users toward selecting the most suitable medical professionals or healthcare services according to their specific needs.

Finally, updating the user interface focuses on usability and accessibility improvements. Using modern front-end frameworks creates a more intuitive and responsive experience. Integrating with external messaging API platforms enhances communication capabilities, fostering seamless conversations between patients and healthcare providers.

A. PERSONALIZED MEDICAL RECOMMENDATION

Adopting personalized medicine recommendations necessitates leveraging advanced machine learning techniques to scrutinize an individual's health history, medical chart, and genetic blueprint, empowering healthcare experts to formulate customized treatment plans.

The choice of appropriate machine learning models significantly influences the development of personalized medicine recommendations, depending on the specific healthcare situation. Predicting patient responses and offering tailored suggestions heavily rely on the effectiveness of these models. Post-training and confirmation, machine learning models are prepared to dispense personalized advice related to medicines and therapies based on individual patient records.Regular upgrades and advancements are indispensable given the changing nature of healthcare knowledge and shifting patient conditions.

B. DOCTOR APPOINTMENT SCHEDULING

The main goal of the doctor appointment scheduling sys- tem is to foster effortless interaction between users and the system's inner workings while providing a user-oriented inter- face through web or mobile devices.The UI module delivers features that enable users to register, log in, and establish consultations with healthcare experts. Patients can peruse available slots based on doctors' schedules and opt for the favored appointment duration.

The DBMS module, is managing essential data entities such as patient records, doctor qualifications, appointment archives, and previous visits.It authenticates user inputs, verifies physician availability, and modifies the appointment history in the database.The doctor appointment scheduling system showcases a range of synchronized modules functioning together to deliver a structured and client-centered scheduling solution. From the UI the reliable DBMS and the predictive capabili- ties of the Machine Learning Module, all components serve indispensable functions in fine-tuning appointment scheduling protocols.

C. EMAIL NOTIFICATION

Introducing email functionalities into a healthcare platform enables improved communication and simplification within healthcare environments. after completing an appointment reservation through the platform, an instant confirmation email should be automatically sent to the patient's specified email address. Essential details like the booked date, time, location, and purpose of the consultation should be included in the message.

Employing a considered approach, reminder notices can be programmed to contact patients one or two days preceding their scheduled appointments. These alerts function as useful reminders, encouraging patients to verify their participation and execute any necessary advance arrangements. This anticipatory tactic notably diminishes the probability of missed appointments, allowing healthcare providers to effectively organize their schedules and minimize disruptions in service provision.Embedding a feedback mechanism within appointment emails enables patients to express their opinions.

D. CHATBOT

This chatbot is created to assist individuals in understanding and managing their health concerns. One of its primary functions is to identify potential illnesses based on reported symptoms through a conversational interface. By comparing reported symptoms with those associated with various medical conditions, the chatbot provides users with essential health updates, encouraging them to seek appropriate medical treatments.

The chatbot also simplifies the process of finding specialized doctors for identified diseases. By connecting patients with healthcare providers who specialize in the specific diseases, the chatbot ensures efficient medical intervention and care delivery.The chatbot can assist users in tracking their symptoms and monitoring their health over time.This feature is particularly useful for individuals with chronic conditions or those who wish to maintain their overall health and well-being.

E. MULTI-DISEASE PREDICTION

To accurately foretell distinct health concerns, such as diabetes, cardiac problems, and Parkinson's disease, the system architecture incorporates several elements focused on machine learning models derived from applicable datasets. Firstly, medical data acquisition takes place, comprising patient demographic details, case histories, and diagnostic exam reports. Post-collection, pre-processing stages include cleaning, standardization, and augmentation of attributes, rendering them suitable for model instruction.

After model establishment, it is necessary to evaluate the models potential to pinpoint the diseases.Patients enter information through the user interface (UI), obtain predictions concerning designated conditions, whereas background processes oversee service administration, directing user inputs towards deployed machine learning models, and relaying results back to UI screen display.This system design harnessing condition-tailored machine learning models generates precise forecasts for diabetes, cardiovascular complications, and Parkinson's disease.

IV. RESULT AND ANALYSIS

Random forest is a powerful ensemble learning algorithm, where multiple decision trees are constructed and aggregated to make predictions. By creating various decision trees, each trained on different subsets of the dataset, random forest aims to reduce over-fitting and improve generalization performance. In this proposed, the specified the number of decision trees, known as n-estimators, to be hundered.

Subsequently, the predictions from all hundred decision trees are combined to produce a final prediction.After ag- gregating the predictions from all decision trees, it computed the average accuracy across all trees. Notably, random forest consistently demonstrated superior performance compared to other machine learning algorithms in Table I employed in

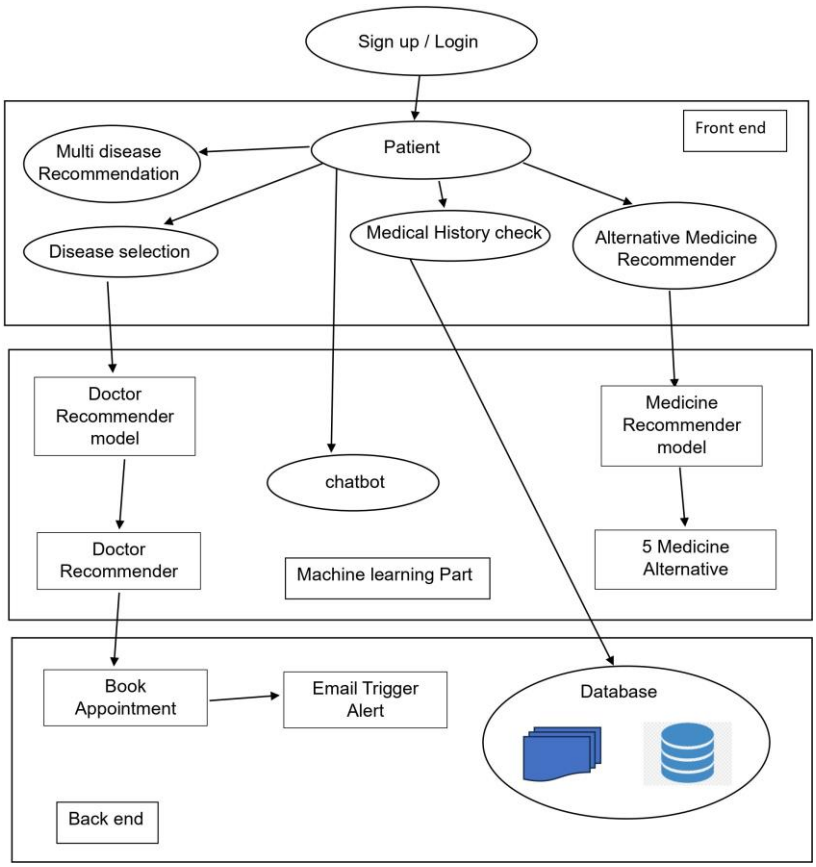

Fig. 1. Overview of the Workflow

TABLE I
COMPARISON OF VARIOUS ML MODELS

S. no	Model Evaluation Metrics				
	Model	*Ratio*	*Accuracy*	*Precision*	*Recall*
1	Logistic Regression	60:40	0.060212	0.000946	0.012576
2	Decision Tree	60:40	0.804191	0.698165	0.0744264
3	Random Forest	60:40	0.804191	0.698165	0.751488
4	SVM	60:40	0.087669	0.005441	0.028086
5	KNN	60:40	0.781310	0.681716	0.726341
6	Logistic Regression	70:30	0.062921	0.000971	0.012822
7	Decision Tree	70:30	0.802247	0.691918	0.739814
8	Random Forest	70:30	0.802247	0.691918	0.739814
9	SVM	70:30	0.083467	0.005687	0.030894
10	KNN	70:30	0.787159	0.684911	0.740552
11	Logistic Regression	80:19	0.067437	0.001067	0.013084
12	Decision Tree	80:19	0.797688	0.684911	0.728050
13	Random Forest	80:19	0.798170	0.682573	0.723766
14	SVM	80:19	0.094412	0.006481	0.033047
15	KNN	80:19	0.785164	0.683789	0.733122
16	Logistic Regression	90:9	0.054913	0.000845	0.014048
17	Decision Tree	90:9	0.795761	0.673356	0.717284
18	Random Forest	90:9	0.797688	0.673977	0.717818
19	SVM	90:9	0.085742	0.005114	0.027595
20	KNN	90:9	0.794798	0.688200	0.737761

this proposed system, including logistic regression, decision tree, support vector machine (SVM), and k-nearest neighbors (KNN).The analysis evaluates several algorithms, including Decision Tree, Logistic Regression, Random Forest, SVM, and KNN, using metrics such as accuracy, precision, and recall.Among these, Random Forest and Decision Tree display the best performance in terms of accuracy, precision, and recall. The ”Fig 2”, explores different dataset proportions, with the 80:19 and 90:9 ratios yielding high accuracy rates.

The sizes of the training and testing datasets can be varied to evaluate their impact on model performance. Interestingly, It is identified that the optimal size, yielding the highest accuracy, was found to be 83.55 % . This suggests that careful consideration of the training and testing data proportions is crucial for achieving optimal performance in machine learning models, such as random forest.

Patients are required to register on the website to utilize the appointment booking services as in ”Fig 3”. This process ensures that patient information is securely stored in the database for future use. Upon successful login, patients can navigate to the appointment booking section as in ”Fig 4” and complete a form outlining their reason for consultation. After submission, patients will receive an email with a unique token

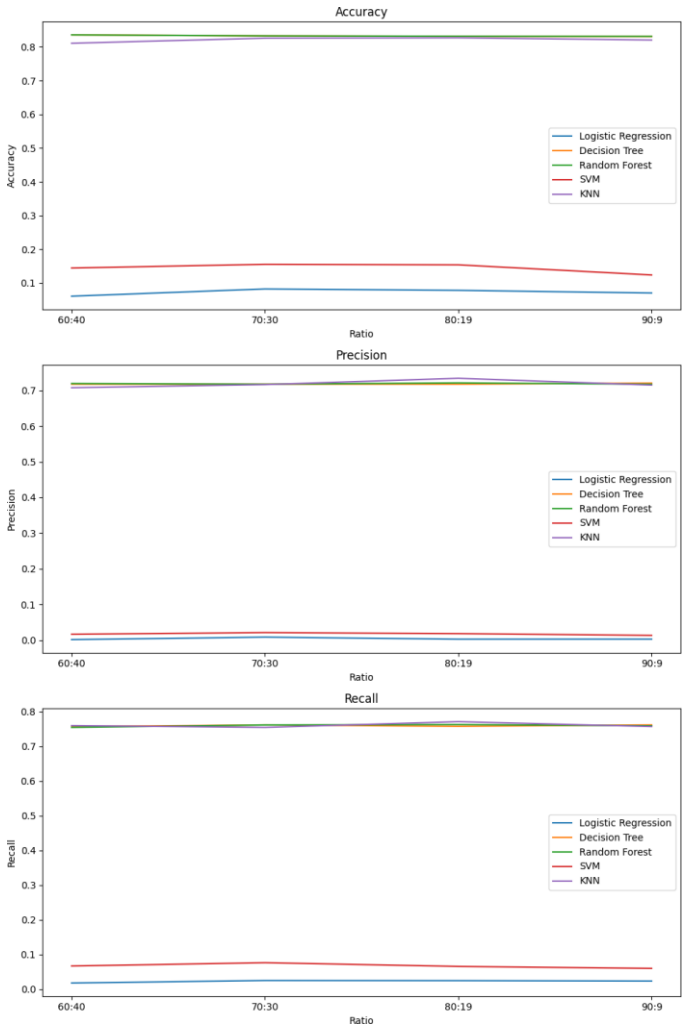

Fig. 2. ML models Performance

Fig. 3. Home Page

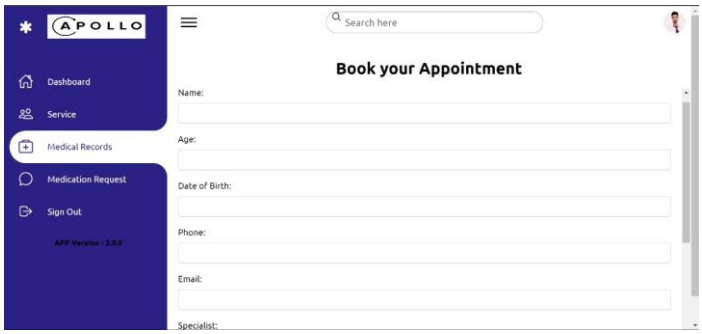

Fig. 4. Appointment Booking Page

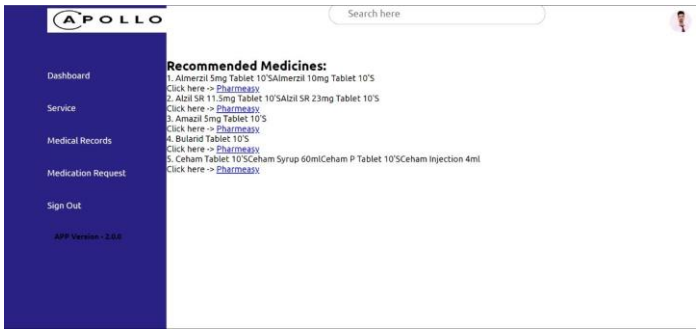

Fig. 5. Provision of Alternative Medicines

number to confirm their appointment.For patients with allergies caused by prescribed medication, the website provides a dedicated page for alternative medicine recommendations in ”Fig 5”. This page showcases a curated selection of alternative medicine options, each tailored to the patient’s specific needs and medical history, offering five suitable choices.

The chat-bot assists users in selecting symptoms for disease prediction and offers healthcare suggestions based on their inputs as in ”Fig 6”. It employs a user-friendly interface where

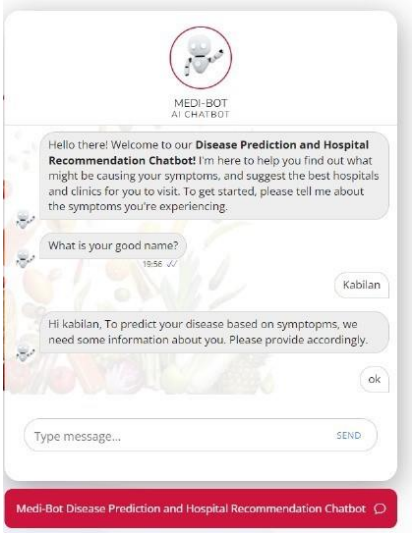

Fig. 6. Chat-bot

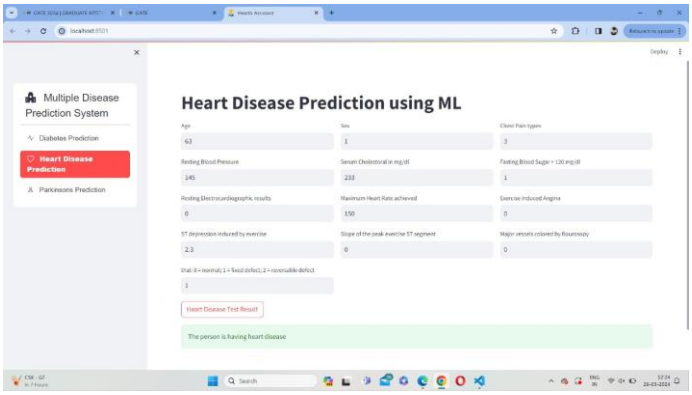

Fig. 7. Heart Disease Prediction

patients can choose symptoms, leading to disease prediction using a RandomForestClassifier model. Once the disease is predicted, the chat-bot provides a list of nearby hospitals for treatment. The chat-bot enhances the user experience by providing efficient healthcare support and facilitating easy access to medical services.

The multi-disease diagnosis employs a RandomForestClassifier model to predict the likelihood of three diseases such as Parkinson's, heart disease, and diabetes as in "Fig 7". It utilizes symptom inputs provided by the user during appointment booking to assess the probability of each disease. The app serves both doctors and patients, requiring specific inputs for accurate disease assessment. It enhances the platform's functionality by providing comprehensive health evaluation alongside appointment scheduling and other healthcare features.

V. FUTURE ENHANCEMENT

To expand access to healthcare services the proposed model is to develop a mobile application that complements the web platform. The objective is to create an app that functions smoothly on both iOS and Android devices, thereby increasing its reach. Partnering with leading wearable health device companies will enables to gather real-time health data such as heart rate, blood pressure, and daily activities. This information can be utilized to provide customized health guidance and proactive suggestions to users. By linking with existing electronic health record systems, healthcare providers will have unhindered access to patient medical histories.

VI. CONCLUSION

This work aims to enhance the productivity and ease of use of healthcare services through innovative technology. The utilization of the Random Forest Classifier within a doctor's appointment system, providing users with a way to make consultations. Additionally, a pharmacy section is integrated to enable smooth drug procurement, supporting ongoing treatment plans. A healthcare chat-bot is introduced to deliver necessary information and guidance, leading to increased user engagement. The email confirmations secure timely notification about scheduled appointments.

The multi-disease detection feature adds value to the platform, empowering users to acquire early knowledge about possible health problems. By utilizing machine learning algorithms and intuitive layouts, the system addresses the diverse expectations of different parties, such as patients and healthcare providers.

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