

Medi Scope: Ai Driven Early Disease Prediction System

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Abstract—Healthcare systems require intelligent tools for early detection of patient deterioration and effective clinical decision-making. This paper presents **MediScope**, a web-based AI-assisted health monitoring and disease risk prediction platform. The system integrates patient and doctor management, electronic health record storage, machine learning-based prediction, and interactive dashboards. MediScope is developed using Flask, SQLite, SQLAlchemy, and frontend technologies such as HTML and JavaScript. A Random Forest model is trained to predict patient progression toward critical conditions based on vital signs and symptoms. The platform provides secure role-based access, real-time prediction, and user-friendly dashboards. MediScope is lightweight, scalable, and designed for accessibility, making it suitable for non-technical users and clinical environments.

Keywords--Health Monitoring, Disease Risk Prediction, Flask, SQLite, Random Forest, Clinical Dashboard, Patient-Doctor System, Explainable AI.

I. INTRODUCTION

Global Healthcare systems face increasing challenges due to the rising burden of chronic diseases and limited availability of clinical resources. Early identification of patient deterioration is critical to improving treatment outcomes and reducing mortality rates. Traditional healthcare dashboards often lack integration with predictive analytics and fail to provide real-time insights. Recent advancements in Artificial Intelligence (AI) and Machine Learning (ML) have enabled predictive modeling using patient health records. However, many existing systems are either complex to deploy or limited to research purposes. There is a need for an accessible, integrated platform that combines patient data management and predictive analytics. To address these challenges, this paper introduces **MediScope**, an AI-based health monitoring system that

integrates secure authentication, patient record storage, and machine learning prediction within a single web application. The system enables doctors and patients to interact with clinical data efficiently and supports early risk detection.

II. LITERATURE SURVEY

Several Early healthcare analytics systems relied on statistical methods and manual clinical scoring techniques. These approaches often lacked scalability and adaptability to large datasets. With the evolution of machine learning, models such as Random Forest, Support Vector Machines, and Neural Networks have demonstrated improved prediction accuracy in healthcare applications. Recent research also highlights the importance of interactive dashboards for visualizing patient data and enabling decision-making. Explainable AI techniques such as SHAP have been introduced to improve transparency in predictive models. Despite these advancements, many existing systems either focus only on prediction or only on visualization. MediScope bridges this gap by integrating data management, prediction, and visualization into a unified platform that is easy to deploy and use.

III. PROPOSED SYSTEM

A. System Overview

MediScope is a complete AI-driven web platform designed for smart health monitoring and disease risk prediction through automated data processing, predictive modeling, and interactive visualization. The system follows a modular architecture consisting of frontend, backend, AI analytics engine, and database layers.

MediScope enables efficient healthcare analysis by integrating patient data collection, machine learning-based prediction, and real-time dashboard visualization. The platform is structured to provide seamless interaction

between users and the system while ensuring accessibility and ease of use for both doctors and patients.

B. System Architecture

As shown in Fig. 1, the overall architecture of the MediScope platform integrates patient data input, preprocessing, Random Forest-based disease risk prediction, and future explainability support into a unified AI-driven pipeline.

The backend manages data processing, model execution, prediction generation, and API communication. The frontend provides interactive dashboards, patient forms, and visualization panels for users. The SQLite database stores patient records, user credentials, and prediction results, ensuring efficient data retrieval and management.

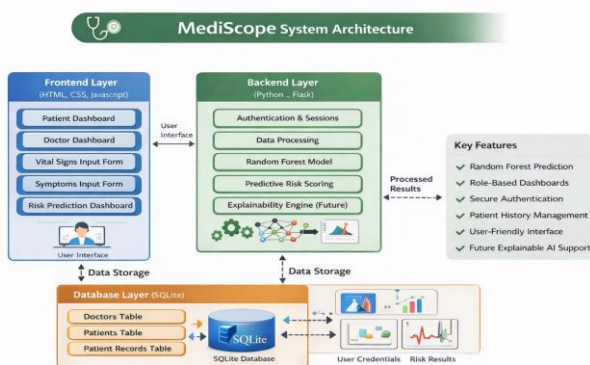


Fig. 1. Overall Architecture of MediScope Platform

Fig. 1. Overall Architecture of MediScope

IV. METHODOLOGY

A. Data Collection and Datasets

The system uses an electronic health record dataset (ehr_data.csv) containing:

- Blood pressure
- Heart rate
- Respiratory rate
- Temperature
- Oxygen saturation
- Medication adherence
- Symptom severity
- Critical condition labels

B. Data Preprocessing

The preprocessing pipeline includes:

- Data loading from CSV
- Feature selection
- Data scaling using StandardScaler
- Train-test splitting

This Pipeline helps the platform use different datasets without needing manual setup.

C. Machine Learning Model (INFO + Optimized ELM)

The main prediction engine in MediScope uses a Random Forest classifier for disease risk prediction. The model is trained on patient health data, including vital signs and symptom-related features. Random Forest is chosen for its high accuracy, robustness, and ability to handle complex healthcare datasets.

The model processes input features such as heart rate, blood pressure, oxygen levels, and symptom severity to predict whether a patient is likely to progress toward a critical condition. The trained model is stored and loaded during runtime using joblib for efficient inference.

Model performance is evaluated using standard metrics such as **accuracy, precision, recall, and F1-score**, ensuring reliable and consistent prediction results.

D. Explainable AI using SHAP

To improve transparency and trust in predictions, MediScope supports Explainable AI using SHAP (SHapley Additive Explanations). SHAP helps interpret how each input feature contributes to the prediction outcome.

SHAP visualizations such as feature importance plots and contribution graphs enable users and doctors to understand how vital parameters like heart rate, oxygen saturation, and symptom severity influence risk prediction. This enhances decision-making and increases system reliability.

E. Forecasting Engine

The forecasting module in MediScope analyzes historical patient health data to identify trends and predict future health risks. Using time-series learning techniques, the system can estimate how a patient's condition may evolve over time.

The module enables tracking of patient health progression and supports early intervention by predicting potential deterioration. This feature is especially useful for continuous monitoring and preventive healthcare.

As shown in Fig. 2, the forecasting engine analyzes past patient records and generates future risk trends, helping doctors make proactive clinical decisions and improving patient outcomes.

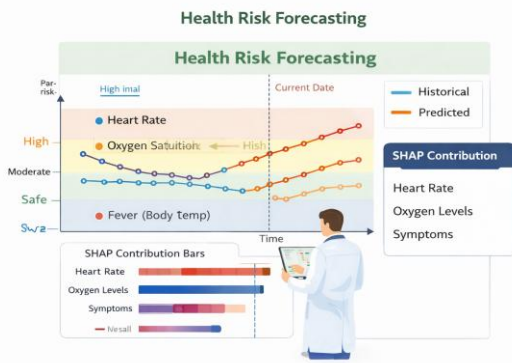


Fig. 2. Health Forecasting in MediFinal

Fig. 2. Future Health Risk Forecasting

V. SYSTEM MODULES

A. USER INTERFACE MODULE

The frontend interface of MediScope is built using HTML, CSS, and JavaScript. It provides an interactive and user-friendly environment for both patients and doctors. The system includes multiple interfaces such as the main dashboard, login pages, and dedicated dashboards for users.

The interface allows users to register, log in, and interact with the system by entering health data and viewing prediction results. The design focuses on simplicity, accessibility, and smooth navigation.

As shown in Fig. 3, the MediScope user interface includes the main dashboard, doctor and patient login pages, and their respective dashboards, providing a complete and seamless user experience.

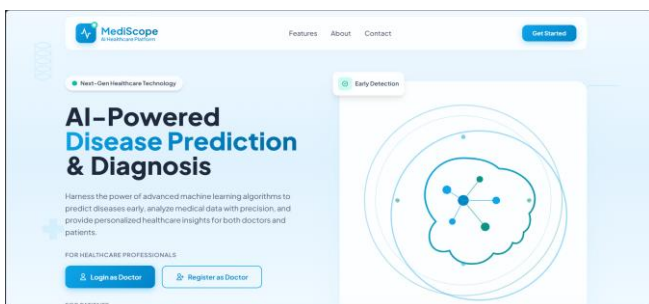


Fig. 3. 1 User Interface Dashboard

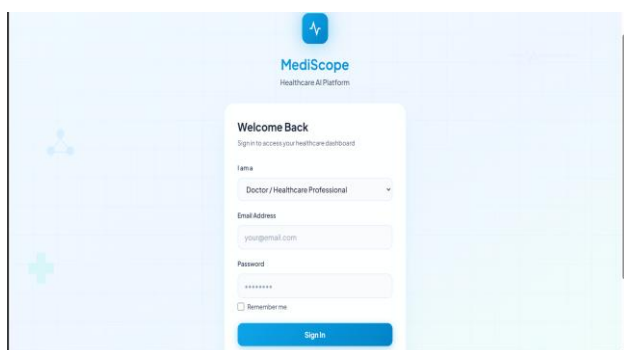


Fig. 3. 2 login Dashboard

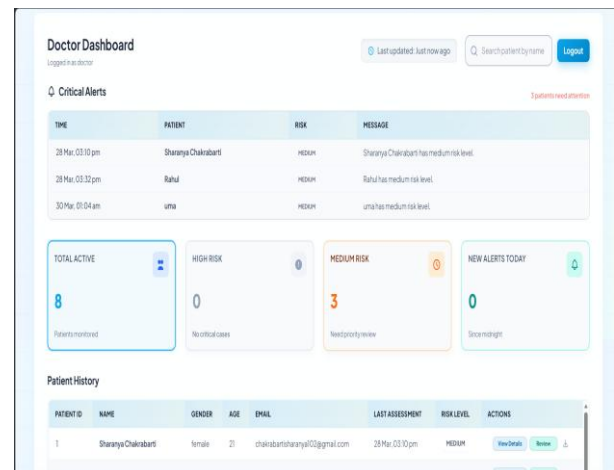


Fig. 3. 3 Doctor's Dashboard

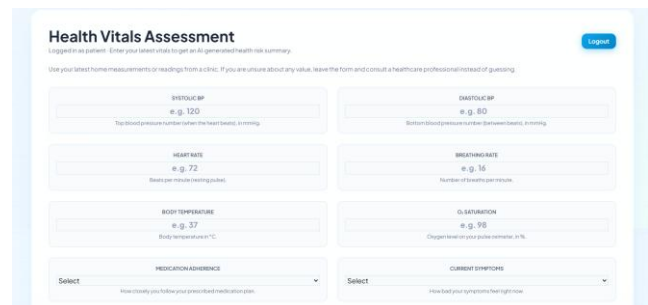


Fig. 3. 4 Patient's Dashboard

B. Backend Processing Module

The backend of MediScope is developed using Flask. It handles user authentication, session management, data preprocessing, and communication between frontend and database. It also manages model execution and ensures efficient system performance.

C. AI Analytics Module

The AI analytics module integrates the Random Forest model for disease risk prediction. It processes patient health data, performs preprocessing, and generates prediction results. This module forms the core intelligence of the system and supports future enhancements like explainable AI.

D. Database Module

SQLite database is used to store user credentials, patient records, prediction results, and session data. This ensures lightweight, secure, and efficient storage of all system information.

VI. RESULTS AND DISCUSSION

A. Dashboard Analysis

The MediScope provides an interactive dashboard that displays patient health information and prediction results. The dashboard updates dynamically based on user inputs and stored data.

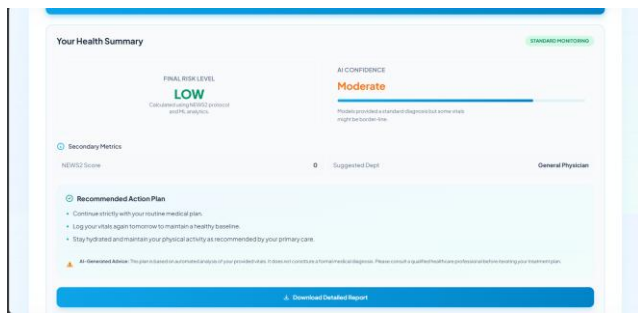


Fig. 4. patient results dashboard

As shown in Fig. 4, the patient results dashboard presents disease risk prediction clearly, helping users understand health conditions effectively.

B. Prediction and Model Performance

The Random Forest model used in MediScope provides accurate and reliable predictions. The model is evaluated using metrics such as accuracy, precision, recall, and F1-score.



Fig. 5. Predicted Disease Risk Using Random Forest Model

C. Visualization and Explainability

The system generates visual outputs such as prediction graphs, health trends, and feature analysis. These visualizations improve understanding and support better decision-making.



Fig. 6. Visualization of Health Data and Prediction Analysis

D. System Efficiency and Usability

MediScope is lightweight and efficient, capable of running on standard systems. The web-based interface ensures easy accessibility and usability for both patients and healthcare professionals.

VII. CONCLUSION

This paper introduced MediScope, a web-based AI-driven healthcare platform for disease risk prediction and health monitoring. The system integrates data preprocessing, machine learning, and interactive dashboards into a single unified application. By utilizing a Random Forest model, MediScope effectively predicts the likelihood of patients progressing toward critical health conditions based on vital signs and symptom data.

Experimental results demonstrate that the system provides reliable prediction performance and meaningful health insights. The platform is lightweight, scalable, and user-friendly, making it suitable for both patients and healthcare professionals. MediScope highlights the potential of AI in improving clinical decision-making and enabling proactive healthcare monitoring.

VIII. FUTURE SCOPE

Future enhancements of MediScope may include the integration of real-time health monitoring using wearable IoT devices, advanced deep learning models for improved prediction accuracy, and cloud-based deployment for large-scale healthcare applications. Additional features such as real-time alerts, personalized health recommendations, multilingual support, and explainable AI (SHAP) for better interpretation of predictions can further enhance the system's usability and effectiveness in modern healthcare environments.

TABLE I. PROJECT MODULES AND DESCRIPTION

Project Module	Description
User Interface	Handles dashboards, login, and user interaction
Preprocessing Module	Data cleaning, normalization and feature selection
AI Prediction Module	Random Forest-based disease risk prediction
Explainability Module	SHAP-based interpretation
Forecasting Module	Future health trend prediction
Database Module	SQLite storage for users and patients records

TABLE II. TECHNOLOGY STACK

Component	Technology
Frontend	HTML, CSS, JavaScript
Backend	FastAPI (Python)
Database	SQLite
Data Processing	Pandas, NumPy
Visualization	Matplotlib
Explainable AI	SHAP
Machine Learning	Random Forest(Scikit-learn)

TABLE III. TEAM CONTRIBUTION

Team Member	Contribution
Member I	AI Model Development, Data Preprocessing, and Prediction Module Implementation
Member II	Frontend Development and Documentation
Member III	Backend Support, Database Management, Testing

ACKNOWLEDGMENT

The authors would like to thank Geethanjali College of Engineering and Technology for providing the academic environment and resources that supported this research work.

The authors express their sincere appreciation to M for her valuable guidance, constructive feedback, and continuous support throughout the development of the Project.

The authors also acknowledge the support of the Department of Computer Science and Engineering for facilitating the successful completion of this work.

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