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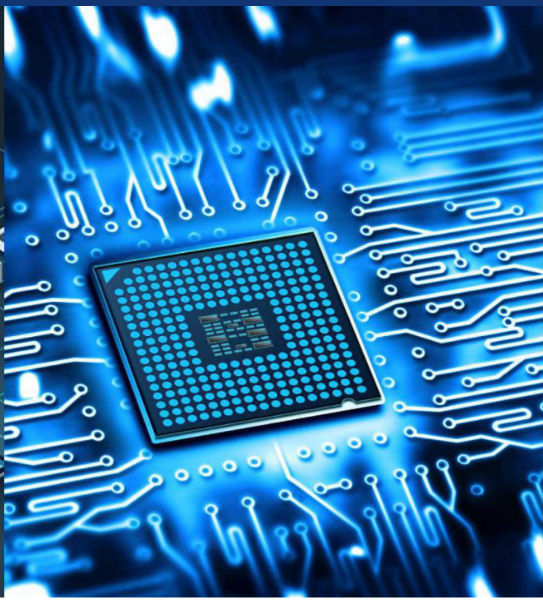

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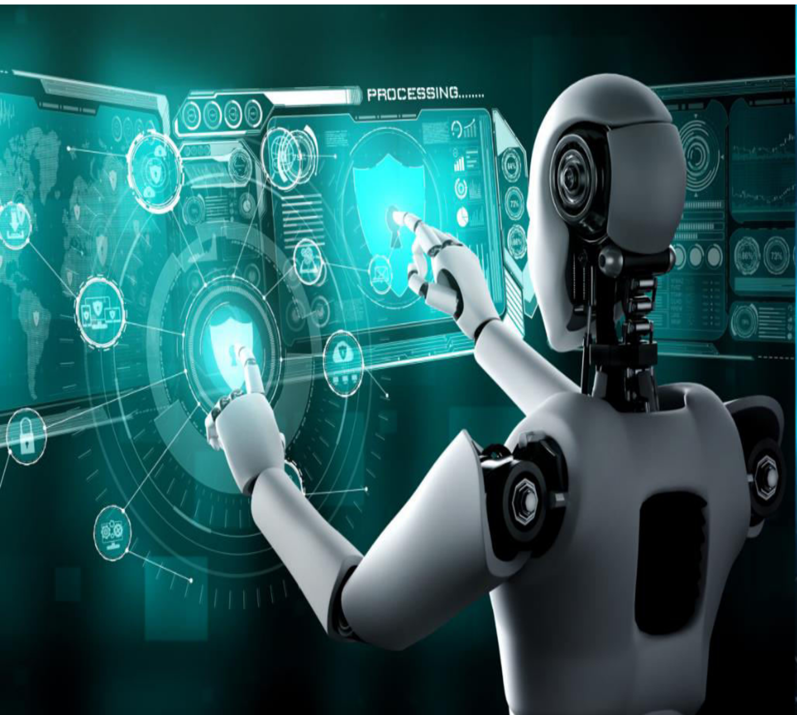

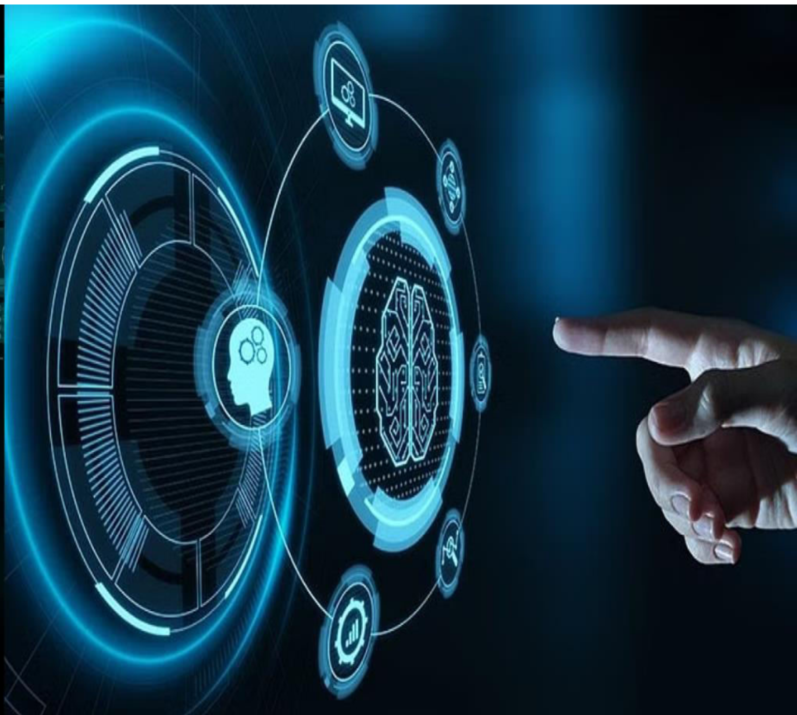

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AI-Based Doctor Appointment Scheduling and Disease Diagnosis

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ABSTRACT: Access to healthcare remains a critical challenge across rural and semi-urban regions of India, where patients encounter difficulties such as limited availability of specialist doctors, communication barriers due to regional language diversity, absence of early screening tools, and fragmented systems for booking medical consultations. These issues often lead to delayed treatment, worsened health outcomes, and unnecessary travel to distant urban hospitals. Swasth AI addresses these challenges through an intelligent healthcare platform that enables users to describe symptoms via text or voice in seven Indian languages, receive AI-powered preliminary health assessments, identify suitable doctors through a multi-factor ranking system, and book appointments with automated email confirmations. Additionally, the platform incorporates a deep learning module for image-based skin condition classification using a Convolutional Neural Network trained on clinical dermatology data.

The system architecture employs React 19 with Next.js 15 for the user interface, a Python-based REST API with PostgreSQL for data management, TensorFlow.js for in-browser model inference, the Web Speech API for multilingual voice recognition, and EmailJS for patient notifications. A geolocation-powered hospital mapping feature helps users identify nearby healthcare facilities without reliance on external map services.

By combining NLP-driven symptom analysis, transfer learning for medical image classification, intelligent scheduling with patient registration, and an emergency alert mechanism, SwasthAI delivers an accessible, technology-driven healthcare experience designed to serve communities with limited medical infrastructure.

KEYWORDS: Artificial Intelligence, Healthcare Platform, Smart Appointment Scheduling, Disease Symptom Analysis, Deep Learning, Transfer Learning.

I. INTRODUCTION

Healthcare delivery in rural and semi-urban India faces persistent structural gaps that prevent timely and effective patient care. A large portion of the population residing in these regions encounters limited access to specialist medical practitioners, inadequate diagnostic infrastructure, significant travel requirements to reach equipped facilities, and communication difficulties arising from linguistic diversity across states and districts.

Patients in these settings frequently lack clarity on which specialist to approach for specific symptoms, what early indicators suggest about potential health conditions, and how to respond during medical emergencies. Furthermore, the absence of organized scheduling mechanisms contributes to overcrowding at public health centers, prolonged waiting periods, and avoidable delays in receiving appropriate treatment.

The increasing penetration of internet connectivity, growth in smartphone adoption, and maturation of technologies such as artificial intelligence, deep learning, and natural language processing present a significant opportunity to transform healthcare accessibility. Intelligent platforms can now assist individuals in understanding health conditions through symptom description, connecting with relevant medical specialists, and completing appointment scheduling through streamlined digital interfaces.

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SwasthAI is developed as a response to these challenges — an AI-powered healthcare platform that integrates multilingual symptom triage with voice input support across seven Indian languages, deep learning-based skin condition classification. intelligent doctor discovery w, appointment booking with automated email confirmation, geolocation-based hospital mapping, and an emergency alert mechanism. The platform is designed to function with minimal internet dependency, ensuring that core features remain operational even in regions with limited network connectivity.

II. RELATED WORK

Existing healthcare platforms such as Practo, eSanjeevani, Ada Health, and SkinVision provide various digital healthcare services. Practo mainly focuses on doctor discovery and appointment booking. eSanjeevani offers teleconsultation services through a government-supported platform. Ada Health uses Artificial Intelligence to analyze symptoms and provide preliminary health assessments. SkinVision applies image processing techniques for skin disease screening. However, these systems generally address only specific healthcare functions. Most platforms lack multilingual voice interaction and regional language support. Many systems also require users to identify the appropriate specialist on their own. Recent research highlights the growing role of Artificial Intelligence in healthcare diagnosis and patient management. Natural Language Processing (NLP) is widely used for symptom analysis and medical text interpretation. Convolutional Neural Networks (CNNs) have shown strong performance in medical image classification tasks. MobileNetV2 is commonly used for efficient image-based disease detection due to its lightweight architecture. Studies indicate that AI-assisted healthcare systems can improve accessibility and decision-making. Despite these advancements, a fully integrated platform combining diagnosis, appointment scheduling, multilingual support, and emergency assistance remains limited. SwasthAI addresses these gaps by providing a unified AI-powered healthcare solution.

III. PROPOSED ALGORITHM

A. SYSTEM ARCHITECTURE:

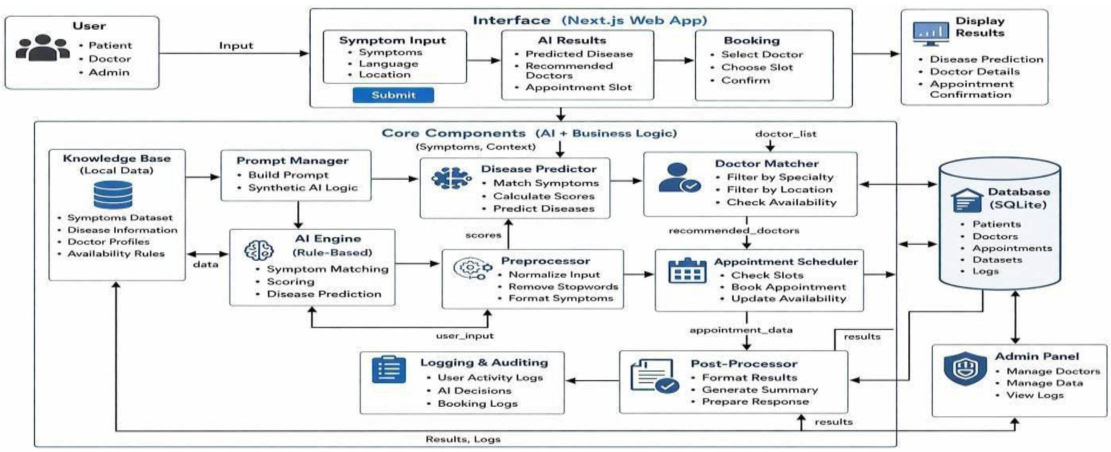

Fig. 1. Proposed System Architecture

B. *DESIGN CONSIDERATIONS:*

- The application preprocesses symptom data using text normalization, keyword extraction, stop-word removal, and symptom mapping techniques.
- A rule-based AI engine is used to match symptoms with diseases and generate preliminary health assessments.
- The disease prediction module calculates confidence scores and severity levels to improve diagnostic reliability.
- A doctor matching mechanism recommends suitable doctors based on specialty, location, availability, and patient requirements.
- The appointment scheduling module automatically checks available slots and manages booking confirmations.
- MobileNetV2-based deep learning is integrated for skin disease image classification, enabling AI-assisted dermatological screening.

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- The system provides emergency escalation support by identifying critical symptoms and suggesting immediate medical actions.
- Logging and auditing features maintain records of user activities, AI predictions, and appointment transactions for monitoring purposes.
- The architecture is designed using Next.js, AI modules, and database integration to ensure scalability, accessibility, and real-time healthcare assistance.

C. *DESCRIPTION OF THE PROPOSED ALGORITHM:*

The proposed algorithm aims to provide intelligent healthcare assistance by analyzing patient symptoms, predicting possible diseases, recommending suitable doctors, and facilitating appointment booking. The algorithm consists of five major stages: symptom collection, data preprocessing, AI-based disease prediction, doctor recommendation and appointment scheduling, and result generation. Additionally, the system supports skin disease classification using deep learning and provides emergency alerts for critical health conditions.

1. Symptom Collection Module

The Symptom Collection Module gathers patient health information through text or voice input in multiple Indian languages. Users can also upload skin images for dermatological analysis. The collected data is validated and forwarded for preprocessing.

Mathematical Representation:

$S = \{s_1, s_2, s_3, \ldots, s_n\}$

Where:

- S = Set of Symptoms
- s_i = Individual Symptom
- n = Number of Symptoms

Input Set:

I = {T, V, M}

Where:

- T = Text Input
- V = Voice Input
- M = Medical Image Input

2. Data Preprocessing Module

The preprocessing module converts raw symptom descriptions into a structured format. It performs text normalization, tokenization, stop-word removal, and multilingual keyword translation to improve prediction accuracy.

Mathematical Representation:

Sp = f(S)

Where:

- S = Raw Symptoms
- Sp = Preprocessed Symptoms
- f = Preprocessing Function

Preprocessing Function:

f(S) = Normalization + Tokenization + Stopword Removal + Keyword Translation

3. Disease Prediction Module

The Disease Prediction Module analyzes processed symptoms using a rule-based AI engine. Symptoms are matched against disease profiles stored in the knowledge base, and confidence scores are generated for predicted conditions.

Mathematical Representation:

D = AI(Sp)

Where:

- D = Predicted Disease
- AI = Disease Prediction Engine
- Sp = Preprocessed Symptoms

Confidence Score:

$Confidence = \min(0.96, 0.54 + Score/10)$

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4. Doctor Recommendation and Appointment Module

After disease prediction, the system recommends suitable doctors based on specialization, location, language support, availability, and ratings. Users can then select a doctor and schedule an appointment.

Mathematical Representation:

Score(d) = Rating(d) + ConditionMatch(d) + LocationMatch(d) + LanguageMatch(d) + TeleconsultBonus(d)

Doctor Recommendation:

R = max(Score(d))

Where:

• R = Recommended Doctor

5. Skin Disease Classification and Result Generation Module

For uploaded skin images, a MobileNetV2-based CNN model classifies the image into one of seven skin disease categories. The system generates disease predictions, confidence scores, urgency levels, recommended actions, doctor suggestions, and appointment confirmations.

Mathematical Representation:

P = CNN(M)

Where:

• P = Predicted Skin Condition
• CNN = MobileNetV2 Model
• M = Input Medical Image

Final Output:

O = {Disease Prediction, Confidence Score, Urgency Level, Recommended Doctor, Appointment Status}

The proposed system provides fast and reliable healthcare assistance through AI-driven symptom analysis, skin disease detection, intelligent doctor matching, appointment scheduling, and emergency healthcare support.

IV. PSEUDO CODE

Step 1: Load the symptom dataset, doctor database, hospital database, and skin disease classification model.
Step 2: Initialize the AI symptom analysis engine and MobileNetV2 skin disease classification model.
Step 3: Load multilingual symptom dictionaries and medical condition profiles.
Step 4: Accept user input through text, voice, or skin image upload.
Step 5: Determine the input type.
IF Input = Voice
    Convert speech to text using Web Speech API.
ELSE IF Input = Image
    Proceed with skin disease image analysis.
ELSE
    Use direct text symptom input.
Step 6: Preprocess symptom text by:

- Converting text to lowercase.
- Removing special characters and stop words.
- Tokenizing symptoms.
- Translating regional language keywords into standard medical terms.

Step 7: Match processed symptoms against disease profiles.
Step 8: Calculate disease scores and confidence levels.
Step 9: Predict the most probable disease and urgency level.
Step 10: Display AI assessment results with confidence score and recommendations.
Step 11: If a skin image is uploaded:
• Resize image to 224×224 pixels.
• Normalize image values.
• Pass image to MobileNetV2 model.
• Predict skin disease category.
• Generate confidence score.
Step 12: Display skin disease classification results and medical guidance.
Step 13: Search doctor database based on predicted disease and user location.

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Step 14: Rank doctors using specialization match, location, language support, ratings, and teleconsultation availability.
Step 15: Display recommended doctors.
Step 16: If user selects a doctor:
• Collect patient details.
• Validate age, phone number, and email address.
• Show available appointment slots.
Step 17: Book appointment and generate unique booking ID.
Step 18: Store appointment details in database/local storage.
Step 19: Send appointment confirmation email using EmailJS.
Step 20: If urgency level = Critical or Emergency:
Display emergency alert.
Provide one-click access to call 112 or ambulance service 108.
Step 21: Use Geolocation API to identify nearby hospitals and healthcare centers.
Step 22: Calculate distance using the Haversine Formula.
Step 23: Display nearby hospitals on the map interface.
Step 24: Save logs of AI predictions, appointments, and user activities.
Step 25: Continue processing new healthcare requests.
Step 26: End.

V.SIMULATION RESULTS

The SwasthAI healthcare platform was successfully tested using various healthcare scenarios. The AI symptom analysis module accurately identified diseases and generated confidence scores based on user symptoms. Multilingual voice input was successfully converted into text using the Web Speech API. The skin disease classification module correctly analyzed uploaded images and predicted skin conditions using the MobileNetV2 model.
Doctor recommendation results were generated based on disease type, location, and specialization.

EVALUATION AND INTERPRETATION OF SYSTEM INTERFACES:

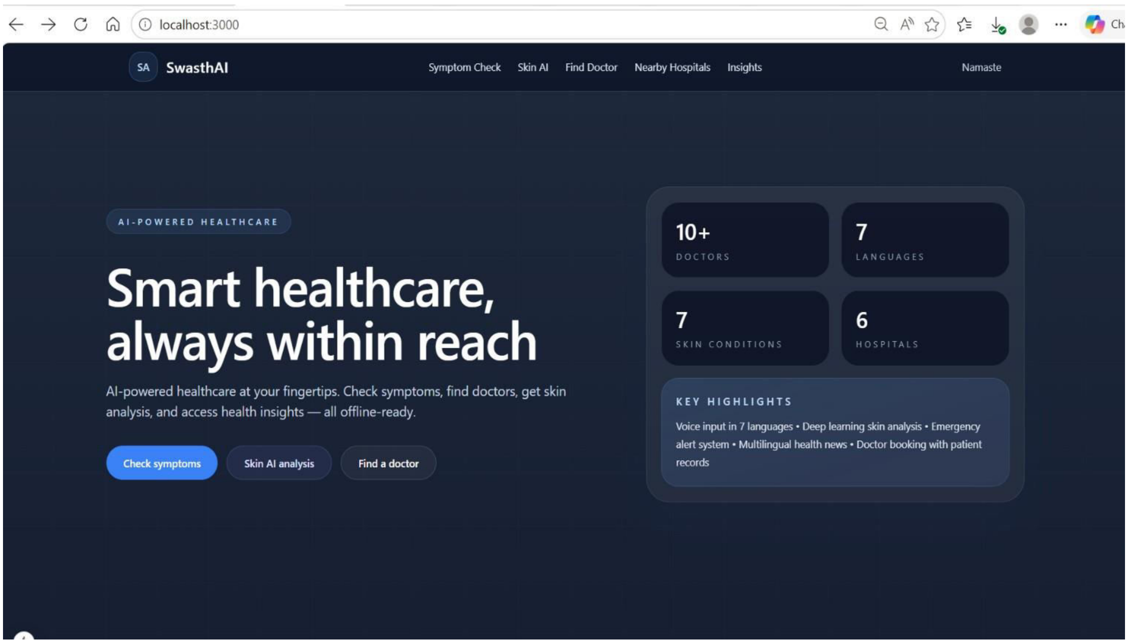

Fig.2. Home Page Interface

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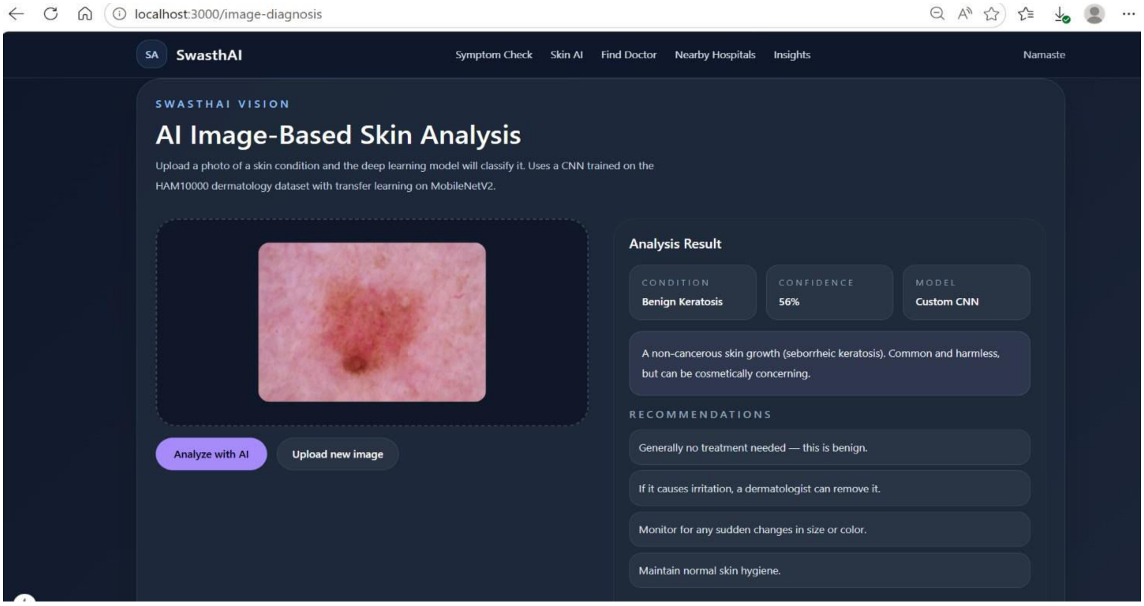

Fig.3. SKIN ANALYSIS

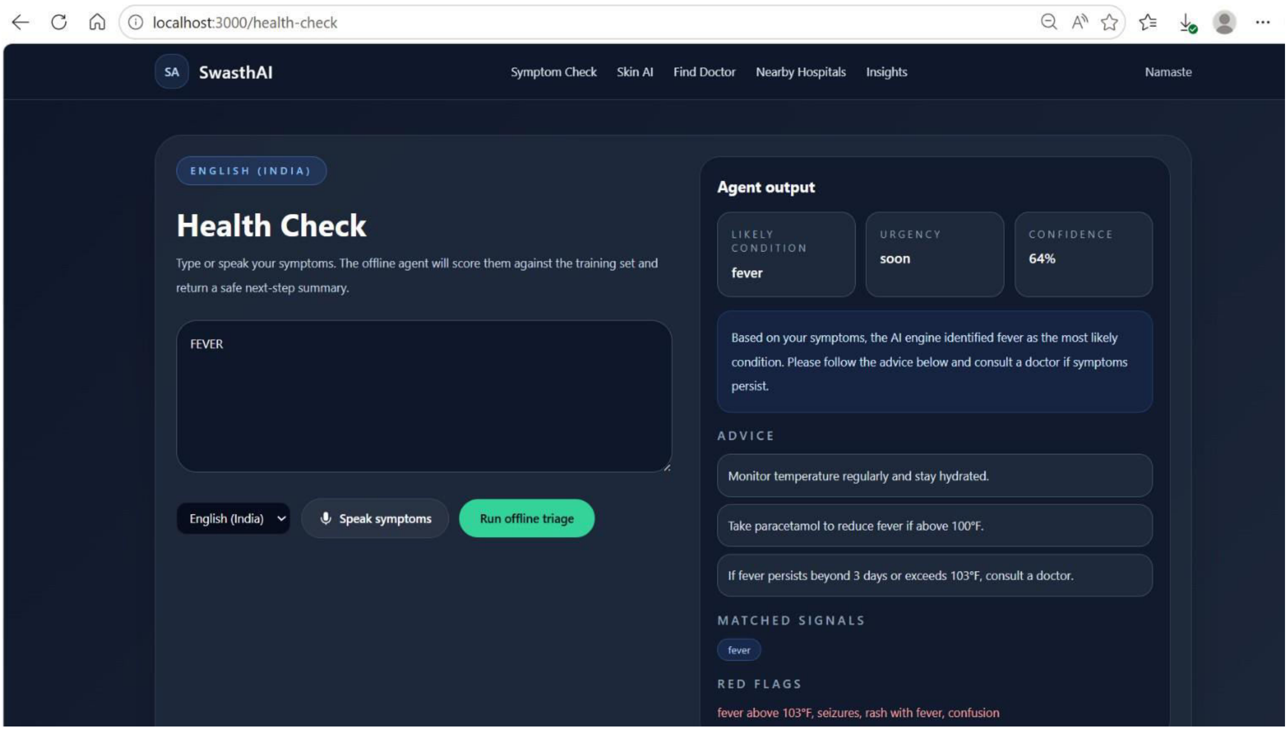

Fig.4. Health check Page

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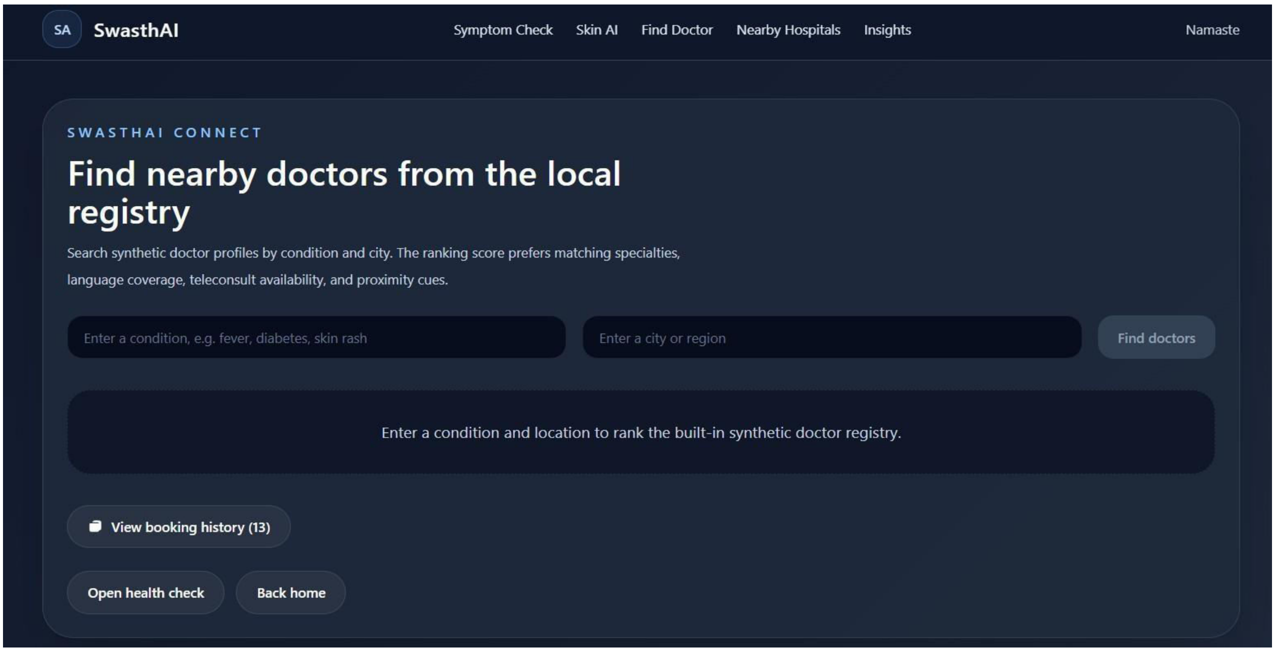

Fig.5. Find Doctor Page

B. Metrics for Evaluation

Standard evaluation measures such as Accuracy, Precision, Recall, and F1-Score are used to assess the effectiveness of the proposed SwasthAI Healthcare Platform. These metrics help evaluate the performance of both the symptom-based disease prediction module and the skin disease classification model.

True Positive (TP): Cases where the system correctly identifies a disease or medical condition.

True Negative (TN): Cases where the system correctly identifies the absence of a disease.

False Positive (FP): Cases where the system incorrectly predicts a disease when the condition is not present.

False Negative (FN): Cases where the system fails to identify an existing disease or condition.

• **Accuracy**

Accuracy represents the ratio of correctly predicted cases to the total number of cases evaluated. It measures the overall effectiveness of the healthcare prediction system.

Equation (5):

$$\text{Accuracy} = (TP + TN) / (TP + TN + FP + FN)$$

• **Precision**

Precision measures how many of the disease predictions made by the system are actually correct. It indicates the reliability of positive predictions.

Equation (6):

$$\text{Precision} = TP / (TP + FP)$$

• **Recall**

Recall measures the system's ability to correctly identify patients who actually have a particular disease or medical condition.

Equation (7):

$$\text{Recall} = TP / (TP + FN)$$

• **F1-Score**

The F1-Score is the harmonic mean of Precision and Recall and provides a balanced evaluation of the model's performance.

Equation (8):

$$\text{F1-Score} = 2 \times (\text{Precision} \times \text{Recall}) / (\text{Precision} + \text{Recall})$$

• **Confidence Score**

The confidence score indicates the certainty of the AI model's prediction. Higher confidence values indicate stronger prediction reliability and help users understand the trustworthiness of the generated results.

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The above evaluation metrics are used to compare and validate the performance of the disease prediction and skin disease classification modules, ensuring accurate and reliable healthcare recommendations.

VI. CONCLUSION AND FUTURE WORK

The SwasthAI demonstrates how artificial intelligence, deep learning, and modern web technologies can collectively address healthcare accessibility challenges faced by communities with limited medical infrastructure. The platform tackles specific barriers including difficulty in symptom communication across languages, absence of preliminary screening tools, lack of awareness about available specialists, and inefficiency of manual appointment processes.

The system delivers a comprehensive healthcare experience through its core capabilities: NLP-powered symptom triage supporting seven Indian languages via text and voice input, CNN-based skin condition classification using a MobileNetV2 model trained on 10,015 clinical images achieving 73% accuracy, intelligent doctor ranking through a multi-factor scoring algorithm, appointment scheduling with automated email confirmation through EmailJS, geolocation-based hospital discovery using the Haversine distance formula, and an emergency alert mechanism for critical conditions. The architecture, built using React 19 with Next.js 15, Python REST API with PostgreSQL, TensorFlow.js for browser-based inference, and the Web Speech API for voice recognition, ensures that core features remain operational even without continuous network connectivity.

The platform is not intended to replace certified medical practitioners but functions as an intelligent preliminary assistant that helps patients articulate health concerns, identify appropriate specialists efficiently, and reduce avoidable delays in accessing proper treatment. This contributes to improved patient awareness, faster decision-making, and more effective utilization of available healthcare resources.

Future enhancements identified for continued development include integration of real-time video consultation for remote medical advice, connection with government health databases such as ABDM and eSanjeevani for verified patient records, training on larger and more diverse dermatological datasets to improve classification accuracy beyond 73%, development of a mobile application using React Native for wider accessibility, implementation of automated appointment reminders through push notifications, and addition of prescription management with medicine tracking functionality.

SwasthAI establishes a practical foundation demonstrating that AI-powered healthcare platforms can meaningfully bridge the gap between patients and medical professionals, particularly in regions where traditional healthcare delivery mechanisms remain insufficient for the population's needs.

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