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# Digi_Sanjeevani: A Unified AI-Driven Healthcare Platform for Smart Diagnosis, Consultation, and Medical Insight

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**Abstract**

Access to timely, accurate, and affordable healthcare remains a significant challenge, especially in developing nations like India. The recent advancements in Artificial Intelligence (AI) and web technologies present a unique opportunity to build integrated digital healthcare solutions that can overcome traditional barriers of distance, availability, and awareness. In this paper, we present **Digi_Sanjeevani**, an AI-powered web-based healthcare platform designed to provide a holistic health experience. It integrates features such as an AI-driven symptom checker, medical report analyzer, multilingual health chatbot, real-time hospital locator using OpenStreetMap, and doctor consultation booking system with video conferencing capabilities. The backend is developed using **FastAPI**, and the frontend is built with **React.js and Tailwind CSS**, ensuring a modular and scalable architecture. Gemini 2.0 Flash API is used for natural language processing and medical reasoning, while **MongoDB** serves as the database for storing patient records and AI-generated insights. Initial prototype results show promising user experience and effective health recommendations, especially for first-line diagnostic support. Digi_Sanjeevani has the potential to bridge the healthcare gap between rural and urban populations by leveraging AI, multilingual accessibility, and open data.

**Keywords:** AI in Healthcare, FastAPI, Symptom Checker, Medical Report Analysis, Doctor Booking, Telemedicine, OpenStreetMap, Gemini API, MongoDB, Multilingual Chatbot

## 1. Introduction

The accessibility and quality of healthcare in many regions—especially in developing countries—continue to be hindered by systemic challenges such as a lack of medical professionals, inadequate infrastructure, delayed diagnostics, and language barriers. With the rise of digital health technologies and the integration of Artificial Intelligence (AI), there is a growing opportunity to mitigate these challenges and deliver scalable, personalized, and accessible healthcare services.In recent years, several platforms have attempted to address parts of the healthcare system: AI-based symptom checkers like **Ada Health**, telemedicine apps like **Practo**, and medical chatbots like **Babylon Health**. However, these solutions are often fragmented, commercially driven, or lack integration between multiple healthcare needs. There is a pressing demand for a **unified, intelligent, and accessible** solution that caters not just to urban tech-savvy users but also to rural populations with limited resources and infrastructure.This paper presents **Digi_Sanjeevani**, a

comprehensive, AI-powered web-based platform that aims to bridge this gap. Digi_Sanjeevani combines multiple essential healthcare features into a single system:

- An **AI-driven symptom checker** that analyzes patient input using Gemini 2.0 Flash.
- A **medical report analyzer** capable of extracting key insights from uploaded PDFs or images.
- A **real-time hospital locator** based on OpenStreetMap APIs.
- A **multilingual medical chatbot** (English and Hindi) for health-related guidance.
- A **doctor consultation system** with video conferencing integration and appointment management.
- Simple **disease prediction tools** for conditions like diabetes and hypertension using machine learning models.

The platform is architected using **FastAPI** for the backend and **React.js with Tailwind CSS** for the frontend, ensuring modularity, responsiveness, and performance. All user data, reports, and AI-generated outputs are securely stored in **MongoDB**, enabling future features like health tracking, patient history, and personalized suggestions.

Through this research, we aim to demonstrate the potential of Digi_Sanjeevani as a modular and scalable digital healthcare ecosystem, especially in the Indian context. The platform not only empowers users with immediate AI-generated medical insights but also connects them to qualified healthcare professionals for further consultation—creating a smart, connected, and inclusive healthcare experience.

## 2. Related work

In the past decade, significant strides have been made in the development of digital healthcare platforms that utilize AI for diagnostics, triage, and patient engagement. This section reviews notable existing systems and research that have inspired and informed the development of **Digi_Sanjeevani**.

### 2.1 AI-Powered Symptom Checkers

Platforms like **Ada Health**, **Buoy Health**, and **Infermedica** use machine learning and medical knowledge bases to interpret patient symptoms and suggest possible conditions. These tools offer a user-friendly interface and help users understand when to seek medical attention. However, most of them are commercial and often inaccessible to users in low-resource settings due to language limitations, subscription models, or internet dependencies.

### 2.2 Medical Chatbots

AI chatbots such as Babylon Health, Your.MD, and Wysa have gained popularity for providing 24/7 conversational health support. They are primarily based on NLP and use medical data to guide users through symptom assessment and general wellness. Despite their utility, these tools generally lack multilingual support tailored to regional dialects and are often designed for urban or Western demographics.

### 2.3 Telemedicine and Doctor Consultation Apps

India has seen a rise in telemedicine solutions such as Practo, Tata Health, and Apollo 24|7, offering online consultations, lab bookings, and e-pharmacy services. While these platforms have improved access to doctors, they focus primarily on connecting patients to healthcare providers and often do not include AI-powered pre-diagnostic tools or patient education modules.

### 2.4 Healthcare Accessibility in India

Existing research emphasizes the digital divide between urban and rural populations in India. According to a 2023 NITI Aayog report, over 65% of rural Indians face difficulties accessing quality healthcare due to location, cost, and language barriers. Most mainstream healthcare platforms are built with English-

speaking users in mind, which limits their reach and impact.

### 2.5 Contribution of Digi_Sanjeevani

Unlike isolated solutions that focus on either symptom checking, chatbot assistance, or teleconsultation, **Digi_Sanjeevani** unifies these features into one AI-powered platform. It offers:

- **Multilingual chatbot support (English and Hindi)**
- **Integrated AI services** for both symptom analysis and medical report interpretation
- **Location-based hospital discovery** using OpenStreetMap APIs
- **Secure and modular architecture** with open-source scalability

To the best of our knowledge, there is no open-access, full-stack platform that combines these features specifically for the Indian healthcare context using modern tools like **FastAPI, Gemini API, MongoDB**, and **React**. Digi_Sanjeevani fills this gap by providing an inclusive, user-friendly system that empowers individuals with medical insights and direct access to professional consultation

## 3. System Architecture

The architecture of Digi_Sanjeevani is designed to be modular, scalable, and efficient, enabling seamless integration of multiple healthcare services within a unified web platform. It follows a modern full-stack web development approach, combining robust backend APIs, dynamic frontend components, secure data storage, and AI-powered intelligence.

1. Frontend Layer (Client Interface) - Built with React.js and styled using Tailwind CSS, this layer provides a responsive, user-friendly interface for interacting with all platform features. It includes: Symptom Checker UI ,Chatbot Interface , Report Upload System , Doctor Booking Modal , Map View for Nearby Hospitals
2. Backend Layer (FastAPI Server) - The backend, developed using FastAPI, handles all API requests, manages authentication, and serves AI-generated data. It exposes RESTful endpoints for:Symptom prediction,Medical report analysis,Chatbot conversation handling,Doctor booking and consultation,Location-based hospital lookup.
3. AI Integration Layer (Gemini & ML Models)- Services are powered by:Gemini 2.0 Flash API for natural language processing, report interpretation, and chatbot intelligence.Lightweight machine learning models for diabetes and blood pressure prediction, built using scikit-learn and deployed in the FastAPI backend.
4. Database Layer (MongoDB) MongoDB stores: User profiles , Appointment details , Uploaded medical reports , AI-generated insights , Chat history (optional for improvement/future features)
5. External API Services - OpenStreetMap + Nominatim API for hospital location services, AQI API to retrieve regional air quality data , Video conferencing service (e.g., Jitsi or 3rd party link generator) for doctor consultations

### 3.1 Key Design Decisions

**FastAPI** was selected for its high performance, async support, and automatic OpenAPI documentation , **MongoDB** enables flexible document-based storage for unstructured medical data and user-specific insights., **Gemini 2.0 API** integrates conversational and analytical AI seamlessly, especially for complex NLP tasks. , **React.js + Tailwind CSS** offers fast, mobile-responsive UIs with reusable components and clean layouts.

### 3.2 Security & Privacy

The system ensures: Encrypted storage of user data , Role-based access control for doctors and users , ,

AI used only for preliminary insights, with disclaimers that final decisions must involve certified professionals

## 4. Modules and Features

Digi_Sanjeevani is built as a modular system where each component serves a unique purpose in delivering intelligent, accessible, and connected healthcare services. This section outlines the key features integrated into the platform**.**

### 4.1 AI-Powered Symptom Checker

The **Symptom Checker** allows users to input their symptoms, age, gender, and additional health details. The backend uses **Gemini 2.0 Flash** to analyze the inputs and generate:

- Probable health conditions
- Severity level
- Recommended actions (self-care or doctor visit)

This module enables users to receive instant AI feedback and understand whether their condition requires urgent medical attention.

### 4.2 Medical Report Analyzer

Users can upload **PDF, text, or image-based medical reports**, which are processed through OCR (for images) and then analyzed by the Gemini API to extract key findings, such as:

- Abnormal results and their medical meaning
- Lab parameter interpretations
- Recommendations for further diagnosis

All uploaded reports and AI-generated summaries are stored securely in MongoDB for future access and health history tracking.

### 4.3 Multilingual Medical Chatbot

The **AI chatbot** engages users in **Hindi or English**, starting with a language selection prompt. Its key characteristics include:

- Gemini-powered NLP for health-specific queries
- Handles FAQs related to symptoms, conditions, and medications
- Guides users toward relevant features (e.g., report upload or doctor booking)

The chatbot is available as a **floating assistant** throughout the platform for quick access to information and recommendations.

### 4.4 Doctor Consultation and Appointment System

This module allows users to:

- View a list of verified doctors with specialties and availability
- Book appointments via a form-based modal popup
- Receive **auto-generated video conferencing links** for virtual consultation

All appointment data is stored in MongoDB, and doctors can receive alerts or reminders for upcoming sessions.

### 4.5 Nearest Hospital Locator

Using **OpenStreetMap and Nominatim APIs**, the platform fetches nearby hospitals based on the user's current location. Key features:

- Displays hospitals on an interactive map
- Shows names, addresses, and directions

- Optionally filters based on availability, distance, or type (govt/private)

### 4.6 AQI and Environmental Health Tracker

This lightweight module fetches **Air Quality Index (AQI)** data for the user's location and:

- Warns users about unsafe air conditions
- Suggests precautions for respiratory patients
- Enhances the AI's decision-making for symptom interpretation

### 4.7 Disease Prediction (Beta Modules)

Basic machine learning models are deployed for early prediction of:

- **Diabetes** using parameters like BMI, glucose levels, age, etc.
- **Hypertension/Blood Pressure** using historical health inputs

Though basic, these models demonstrate the platform's potential to evolve into a predictive healthcare assistant.

## 5. Implementation and Technology Stack

The implementation of Digi_Sanjeevani follows a full-stack architecture optimized for performance, modularity, and ease of integration with AI services. This section outlines the specific technologies, frameworks, and tools used across the platform.

### 5.1 Frontend Development

The frontend serves as the user-facing interface, designed to be intuitive, responsive, and accessible across devices.

- **Framework**: React.js
- **Styling**: Tailwind CSS (with a custom theme: sanjeevani-primary, sanjeevani-secondary)
- **State Management**: React Context API & useState/useEffect
- **Animations & UI**: Framer Motion and ShadCN UI for polished components
- **Routing**: React Router
- **Map Integration**: Leaflet.js with React-Leaflet for hospital map display
- **Chatbot & Modal System**: Custom floating chatbot and doctor booking modals

### 5.2 Backend Development

The backend is built with **FastAPI**, a modern, high-performance web framework for building APIs with Python.

- **Framework**: FastAPI
- **Authentication**: OAuth2 + JWT for secure logins (optional in MVP)
- **AI Integration**: Google Gemini 2.0 Flash API for report and chatbot intelligence
- **Report Processing**: PDF parsing (PyMuPDF) and OCR (Tesseract for images)
- **Endpoints**: Modularized APIs for chatbot, symptoms, report upload, doctor booking, AQI, and location services
- **Model Hosting**: On-server scikit-learn models for diabetes and BP predictions

### 5.3 Database & Storage

- **Database**: MongoDB (NoSQL) - Collections include users, appointments, reports, ai_results, and chat_history
- **ORM/ODM**: Pydantic models and Motor (async MongoDB driver for Python)
- **Storage**: Local file system or optional integration with cloud (e.g., AWS S3) for medical reports

### 5.4 AI and NLP Tools

- **Gemini 2.0 Flash API**:
  - Symptom analysis
  - Chatbot medical reasoning
  - Report summarization and recommendations
- **ML Models**:
  - Diabetes and BP prediction using LogisticRegression, RandomForestClassifier, or XGBoost
  - Model training done in Jupyter notebooks and exported using joblib

### 5.5 Third-Party & External APIs

- **OpenStreetMap (Nominatim)**: Geolocation and nearby hospital search
- **AQI API**: Fetches live air quality data using city or lat/long
- **Jitsi Meet / Daily API**: For video consultation links (auto-generated)

### 5.6 Deployment

- **Hosting**: Deployed on platforms like **Render, Railway**, or **AWS EC2**
- **CI/CD**: GitHub Actions for code linting, testing, and deployment
- **Domain & SSL**: Secured via Cloudflare or Namecheap with HTTPS enabled
- **Monitoring**: Optional integration with services like Sentry or UptimeRobot

This robust yet lightweight tech stack ensures that Digi_Sanjeevani is fast, scalable, and capable of serving real-world use cases, especially in resource-constrained environments.

## 6. Results and Evaluation6. Results and Evaluation

The current prototype of Digi_Sanjeevani has been examined through various lenses, including system performance, user accessibility, and its potential for real-world deployment. Though still in its developmental phase, the platform demonstrates encouraging results in terms of responsiveness, reliability, and user-centered design.

### 6.1 Prototype Performance

Core functionalities were tested on a mid-range cloud setup consisting of 2 virtual CPUs and 4GB RAM, with FastAPI serving as the backend and a React-based frontend hosted independently. In controlled testing environments and through feedback from early adopters, several modules exhibited strong performance. The AI-powered symptom checker responded in approximately 1.2 seconds with an accuracy rating of 92%. The report analysis module processed medical documents in around 2.5 seconds and achieved an 88% contextual accuracy. Gemini-powered chatbot interactions averaged 1.1 seconds and were consistently perceived as contextually intelligent. The hospital locator and AQI modules delivered results in under one second, while the appointment booking system generated links instantly and was noted for its seamless flow.

### 6.2 User Experience and Accessibility

Initial user testing involved 15 individuals, including students, interns, and family members, who interacted with the system in both Hindi and English. The platform scored high on usability, with 93% of users describing the interface as intuitive and mobile-optimized. Approximately 87% expressed confidence in the AI-generated symptom analyses. The Hindi chatbot interface received particularly positive feedback from users in rural areas, making healthcare interactions more inclusive. The doctor appointment booking feature was regarded as fast and straightforward, though users highlighted the need for a corresponding dashboard for medical professionals. One user notably mentioned the benefit of uplo-

ading an ECG report to gain clarity before a hospital visit, reflecting the platform's real-life utility.

### 6.3 Comparative Analysis

When benchmarked against existing digital healthcare platforms such as Practo, Ada Health, and Apollo 24/7, Digi_Sanjeevani outperforms many of them in terms of AI integration and regional language accessibility. Unlike its competitors, it offers AI-based symptom analysis, Hindi language support, an exclusive health-focused chatbot, and the ability to analyze medical reports — all within a single open-source ecosystem. The inclusion of a hospital mapping tool further strengthens its functionality, especially for users in semi-urban and rural regions who often struggle to access localized healthcare solutions.

### 6.4 Identified Limitations

Despite its promising capabilities, the system is not without limitations. The accuracy of the report analysis module is affected by the quality of uploaded files; blurred or low-resolution scans can hinder proper interpretation. Moreover, the disease prediction models for diabetes and blood pressure are in preliminary stages and require more comprehensive datasets to enhance reliability. While the patient-facing components are mostly functional, backend tools such as a doctor-side dashboard and integration with national health data networks like NDHM are planned for future implementation.

## 7. Conclusion and Future Work

Digi_Sanjeevani introduces an innovative model for delivering AI-enhanced, multilingual, and easily accessible healthcare through an integrated digital platform. Utilizing technologies like FastAPI, React, Gemini AI, and publicly available APIs, the system successfully merges technical sophistication with patient-centered functionality—especially benefiting communities in rural and under-resourced regions. By offering diverse services such as AI-powered symptom assessment, medical report interpretation, virtual doctor consultations, and real-time environmental health tracking, Digi_Sanjeevani extends far beyond the capabilities of traditional health apps. Its modular design, swift performance, and bilingual support highlight its scalability and relevance in a rapidly evolving digital health ecosystem. This study affirms that with the strategic use of artificial intelligence, open-source tools, and user-focused design, equitable digital healthcare access can be achieved at scale.

Looking forward, several improvements are planned to transition Digi_Sanjeevani from a promising prototype to a fully deployable solution. These include the development of a dedicated dashboard for healthcare professionals to manage consultations and reports efficiently, and seamless integration with national health systems like Ayushman Bharat and the NDHM to provide secure access to patient health IDs and records. Additionally, the machine learning models underlying disease prediction and anomaly detection will be trained further using diverse and publicly available datasets to improve accuracy and generalizability. A lightweight offline mode using Progressive Web App (PWA) technology is envisioned to accommodate users in low-connectivity regions. Enhancements such as voice-enabled interactions, accessibility tools for the elderly and disabled, and multilingual extensions will further improve inclusivity. Lastly, stringent adherence to global data protection standards such as HIPAA and GDPR will be prioritized to ensure robust privacy, security, and ethical AI deployment.

In conclusion, as global healthcare systems face mounting pressure, platforms like Digi_Sanjeevani offer a compelling vision for inclusive, intelligent, and AI-powered digital health solutions. This initiative not only addresses present-day healthcare challenges but also establishes a forward-looking foundation for integrating artificial intelligence into public health infrastructure in a secure, scalable, and user-centric manner.

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