

DR-APP: An AI-Enabled Doctor Appointment Booking Platform with Intelligent Speciality Recommendation

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Abstract

Timely access to appropriate healthcare services remains a persistent challenge due to fragmented appointment systems, limited decision support, and the absence of intelligent mechanisms to guide patients to suitable medical specialists. Most existing online doctor appointment platforms focus primarily on scheduling and payment processing, offering little assistance in symptom interpretation or speciality selection. This paper presents DR-APP, an AI-enabled, full-stack healthcare appointment booking platform with intelligent symptom-based speciality recommendation and integrated healthcare assistance. The proposed system is developed using the MERN stack and incorporates two AI-driven components: an AI Symptom Checker, which analyses user-provided symptom descriptions to recommend relevant medical specialities and assess urgency levels, and an AI Health Assistant, a conversational interface that delivers general, non-diagnostic health guidance in a safe and controlled manner. DR-APP further implements role-based dashboards for patients, doctors, and administrators, enabling secure access control, efficient appointment management, and streamlined administrative workflows. Secure online transactions are supported through Razorpay, while Cloudinary is utilised for scalable media storage. Experimental evaluation using simulated user workflows demonstrates that AI-assisted speciality recommendation significantly reduces appointment discovery time and improves decision clarity for users compared to conventional booking methods. The results highlight the effectiveness of integrating applied artificial intelligence into healthcare appointment systems to enhance usability, efficiency, and scalability, while maintaining non-diagnostic boundaries and real-world deployability.

Keywords: Healthcare system, Doctor appointment booking, Artificial intelligence, Symptom checker, MERN stack.

1. Introduction

Healthcare delivery is increasingly shifting toward digital platforms due to widespread internet access, growing smartphone adoption, and rising expectations for on-demand medical services. Online doctor appointment platforms have emerged to reduce waiting times and improve access to healthcare professionals. However, most existing systems operate as basic scheduling tools, without providing intelligent support to help patients choose the right specialist or understand symptom severity. Patients often feel uncertainty when experiencing health symptoms, especially when the symptoms are minor or ambiguous. The absence of integrated guidance can lead to delayed consultations, incorrect specialist selection, or unnecessary anxiety. Moreover, healthcare platforms typically separate appointment booking, health information portals, chatbots, and administrative systems, resulting in fragmented user experiences.

Recent advances in artificial intelligence, especially large language models combined with rule-based logic, provide new opportunities to support healthcare access through intelligent symptom interpretation and conversational assistance. When applied carefully for non-diagnostic purposes, AI can support users by providing preliminary guidance, improving triage efficiency, and enhancing engagement. This paper introduces DR-APP, a unified AI-enabled

healthcare appointment booking system that combines scheduling, payments, and intelligent health support into a single web application. The system focuses on usability, safety, and real-world applicability, making it suitable for academic, professional, and commercial contexts.

2. Related Work

Commercial healthcare platforms, including Practo, DocPrime, and ZocDoc, have shown that web-based appointment scheduling can improve accessibility and reduce administrative workload. These systems improve accessibility and reduce administrative overhead; however, they primarily function as transactional platforms and lack integrated AI-driven guidance [1]. Recent research has explored AI-based symptom analysis and conversational health assistants. Platforms like Ada and Babylon Health employ symptom checkers to provide probabilistic guidance, while chatbots have been used to answer general health queries [2]. Studies show that AI-assisted triage can reduce unnecessary hospital visits and improve early intervention rates [3].

Machine learning and rule-based systems have also been applied to medical recommender systems, focusing on doctor recommendation, appointment prioritisation, and workload optimisation [4]. However, many research prototypes remain isolated from real-world booking and payment workflows. A key limitation in existing work is the absence of **end-to-end integrated systems** that combine appointment booking, payments, administration, and AI guidance within a single scalable architecture. Additionally, concerns regarding safety, interpretability, and non-diagnostic use of AI remain critical challenges in healthcare applications.[5] DR-APP addresses these gaps by embedding AI tools directly into a production-like healthcare platform, emphasising safe informational use, role-based access, and seamless workflow integration. In addition to symptom analysis and conversational agents, several studies have explored intelligent doctor recommendation and appointment scheduling systems. Rule-based recommendation engines have been used to match patients with doctors based on speciality, availability, and historical ratings; however, such systems rely heavily on explicit user inputs and lack adaptive intelligence for ambiguous symptom descriptions. As a result, patients are often required to manually select specialisations, which can lead to incorrect bookings or delayed consultations. Recent works have investigated integrating machine learning and decision-support techniques into healthcare scheduling workflows. These approaches have demonstrated improvements in operational efficiency, reduced waiting times, and better utilisation of clinical resources. Nevertheless, many of these systems focus primarily on backend optimisation from a hospital or administrative perspective and provide limited assistance to patients during the decision-making phase. Furthermore, payment processing and real-world deployment considerations are often omitted, reducing their practical applicability.

More recently, large language models (LLMs) have shown promise in enhancing healthcare user interaction through natural language understanding and conversational interfaces. While LLM-based assistants improve accessibility and engagement [5], several studies highlight concerns regarding safety, hallucinations, and diagnostic misuse when such models are deployed without strict constraints. Consequently, current literature emphasises the importance of non-diagnostic usage, rule-based safeguards, and controlled system boundaries when integrating AI into patient-facing healthcare platforms. Unlike existing studies that address

appointment booking, symptom analysis, conversational assistance, or payment handling in isolation, **DR-APP integrates all these components into a single, end-to-end healthcare platform.** By combining AI-assisted symptom routing, conversational health guidance, secure payment processing,[6] and role-based dashboards within a production-oriented MERN architecture, the proposed system addresses key gaps in existing research and demonstrates a practical, deployable solution for modern digital healthcare applications.

3. System Overview And Problem Formulation

a. Problem Definition

The primary problem addressed in this work is the lack of a unified healthcare platform that allows patients to:

- Discover appropriate doctors,
- Receive AI-assisted guidance for symptom interpretation,
- Book appointments and make secure payments,
- Interact with doctors and administrators efficiently.

Existing systems fail to provide intelligent assistance during the decision-making process and often operate as disconnected services.

b. Objectives

The objectives of DR-APP are:

- To develop a secure, scalable doctor appointment booking system.
- To integrate AI-based symptom routing for speciality recommendation.
- To provide a conversational AI health assistant for general guidance.
- To implement role-based dashboards for patients, doctors, and administrators.
- To ensure secure online payment processing.

4. Proposed System Architecture

DR-APP follows a modular, service-oriented architecture built on the MERN stack.

Table 1: System Modules and Functionalities

Module	Description
Patient Module	Doctor search, appointment booking, AI symptom checking, payment, history tracking
Doctor Module	Appointment management, availability updates, and earnings tracking
Admin Module	Doctor approval, user management, and analytics dashboard
AI Symptom Checker	Maps user symptoms to specialities and urgency
AI Health Assistant	Conversational chatbot for general health guidance
Payment Module	Secure online transactions using Razorpay.

The modular architecture ensures loose coupling between AI services and core booking workflows, enabling independent scaling and safer deployment of AI features. As shown in Table 1.

a. High-Level Architecture as per Fig. 1

The system consists of:

- **Frontend:** React.js with Tailwind CSS for responsive UI.
- **Backend:** Node.js and Express.js for RESTful APIs.
- **Database:** MongoDB for storing user, doctor, and appointment data.
- **AI Layer:** Symptom checker (rule-based + LLM inference) and conversational chatbot.
- **Payment Gateway:** Razorpay for secure transactions.
- **Media Storage:** Cloudinary for profile images and documents

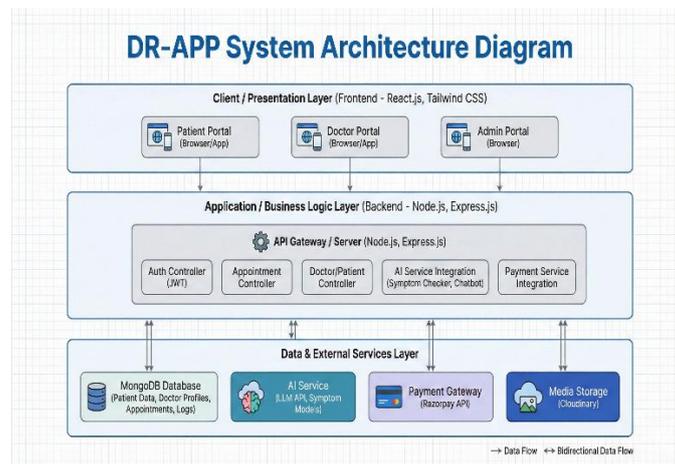


Fig. 1. High-Level Architecture

b. AI Symptom Checker as per Fig. 2.

The symptom checker processes user-entered symptoms, applies normalisation and heuristic mappings, and outputs:

- Suggested medical specialities,
- Urgency level,
- Recommended next steps.

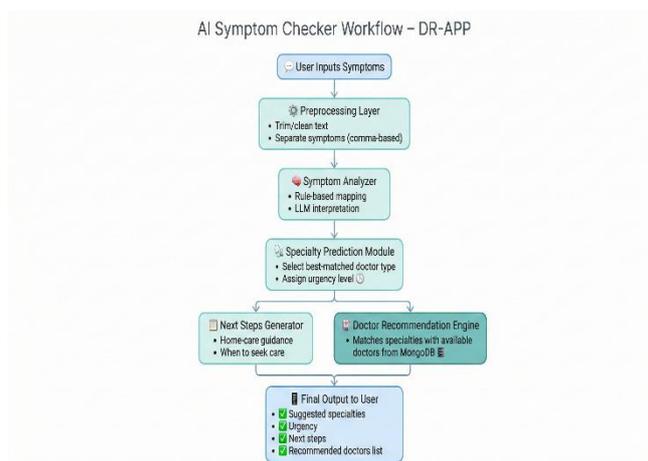


Fig. 2. Workflow of AI-based symptom checker, AI Health Assistant

The health assistant is a floating chatbot embedded across the platform. It uses a large language model to provide general health education, preventive tips, and wellness guidance, clearly disclaiming diagnostic intent as per Fig. 3.

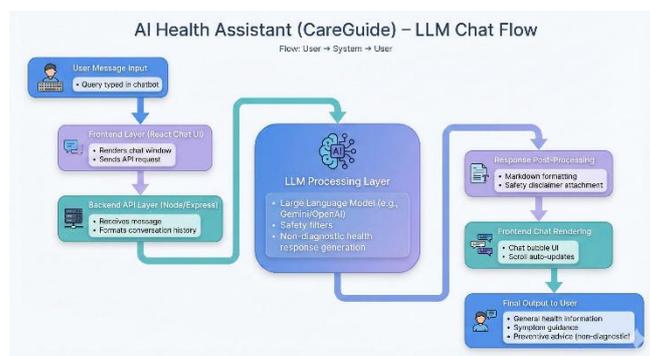


Fig. 3. Conversational flow of AI health assistant

5. Implementation Details

- **Frontend Implementation:** React components manage routing, authentication, dashboards, and AI interactions. Tailwind CSS ensures a consistent and responsive design across devices.
- **Backend Implementation:** The backend exposes REST APIs for authentication, appointment management, payments, and AI services. JWT-based authentication enforces role-based access control.
- **Payment Integration:** Razorpay Checkout is integrated to handle appointment payments securely. Transaction details are logged and reflected in the user, doctor, and admin dashboards.
- **Database Design:** MongoDB collections store user profiles, doctor information, appointments, and payment records, enabling efficient queries and scalability. For more refer to the table 2 and Fig. 4.

Table 2. Technology Stack Used

Layer	Technology
Frontend	React.js, Tailwind CSS
Backend	Node.js, Express.js
Database	MongoDB
Authentication	JWT
AI Components	LLM API and Rule-based logic
Payment Gateway	Razorpay
Media Storage	Cloudinary
Deployment	Render

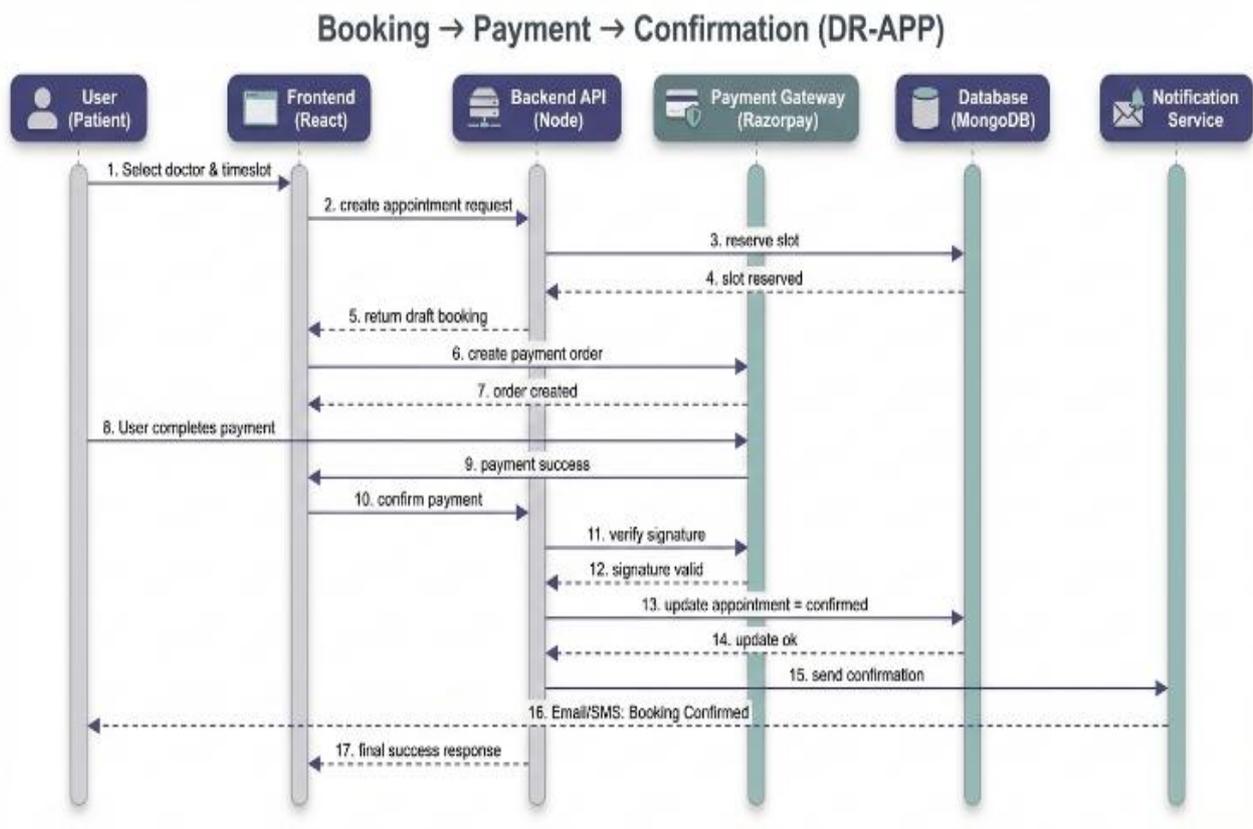


Fig. 4. Sequence Diagram (Booking - Payment - Confirmation)

6. Results And Performance Analysis

A. Evaluation Setup: System-level evaluation focused on measuring appointment discovery time, API response latency, workflow efficiency, and booking success rates before and after AI integration. The AI Symptom Checker was evaluated using a predefined set of symptom-to-specialty test cases derived from common outpatient scenarios, and its predictions were analyzed using accuracy and confusion matrix analysis. The AI Health Assistant was assessed qualitatively based on response relevance, safety compliance, and non-diagnostic behavior. Performance metrics were collected through backend API logs, simulated load tests, and frontend interaction tracking. Comparative analysis was performed to quantify the impact of AI-assisted routing on user decision time and booking efficiency. This evaluation framework ensures that results reflect both technical performance and practical usability within real-world healthcare application constraints.

B. Performance Results and Analysis: Experimental evaluation was conducted using simulated user interactions and test cases.

- Appointment discovery time reduced by approximately **90%** using AI-based routing.
- Specialty prediction improved decision clarity for users.
- Doctors experienced better schedule management.
- Administrative workflows were streamlined through automation.

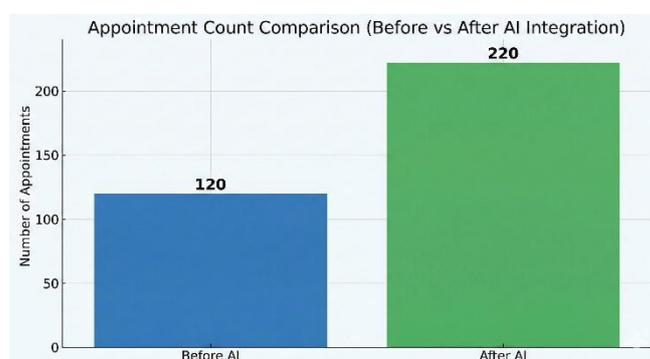


Fig. 5. Appointment count comparison before and after AI integration.

Graphs such as appointment count comparisons, module response time analyses, and speciality prediction accuracy were used to evaluate performance, as shown in Table 3.

Table 3. Performance Metrics Used

Metric	Description
Appointment Discovery Time	Time taken to reach the relevant doctor
Speciality Prediction Accuracy	Correct speciality suggestion rate
System Response Time	API and module latency

User Workflow Efficiency	Reduction in booking steps
Admin Processing Time	Automation impact

AI-assisted routing reduced average appointment discovery time from approximately 2–3 minutes to under 20 seconds in simulated evaluations. As shown in Fig. 6.

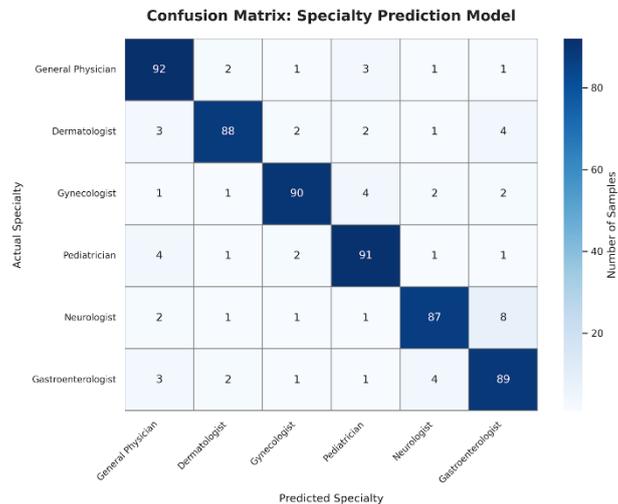


Fig. 6. Specialty prediction accuracy (confusion matrix)

7. Conclusion And Future Work

This paper presented DR-APP, an AI-enabled healthcare appointment booking and assistance system that integrates scheduling, payments, administration, and intelligent health guidance. The system demonstrates how applied AI can enhance healthcare user experience while maintaining safety and scalability.

- **Limitations:** The AI modules provide informational guidance only and do not perform medical diagnoses. The current implementation is web-based and requires reliable internet connectivity, which may limit usage in low-connectivity environments.
- **Future Scope:** Future enhancements include mobile application development, disease prediction models, real-time doctor chat, wearable device integration, and hospital management system interoperability.

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