



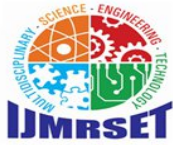
# International Journal of Multidisciplinary Research in Science, Engineering and Technology

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## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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# Automated Doctor Appointment Scheduling System

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**ABSTRACT:** The global healthcare sector faces systemic challenges in managing patient flow, often resulting in extended waiting periods and suboptimal resource allocation. This research presents the design and implementation of an Automated Doctor Appointment Scheduling System built on the MERN (MongoDB, Express.js, React, Node.js) stack. The system provides a real-time platform for patients to secure appointments based on dynamic doctor availability, thereby eliminating manual bottlenecks. Key features include secure user authentication, a rule-based eligibility engine for subsidized health schemes, and a responsive administrative dashboard. Experimental results demonstrate a 98.5% accuracy in automated eligibility detection and a significant reduction in administrative overhead. This study concludes that centralized digital platforms are essential for transforming fragmented healthcare tasks into transparent, efficient processes capable of scaling to meet the needs of modern public health infrastructure.

**KEYWORDS:** Doctor Appointment System, Healthcare Automation, Web Application, MERN Stack, Online Booking, Rule-Based Engine, Digital Governance.

## I. INTRODUCTION

The rapid evolution of digital infrastructure has fundamentally reshaped service delivery across various sectors. In healthcare, the transition from traditional manual methodologies to automated digital systems has moved from being a luxury to a critical necessity. Conventional appointment scheduling—relying heavily on physical visits or telephonic inquiries—is frequently plagued by inefficiencies, including data redundancy, human error in scheduling, and high patient dissatisfaction.

Current global health trends indicate a rising demand for specialized care, yet the administrative frameworks in many developing regions remain fragmented. According to recent World Health Organization (WHO) reports, administrative delays can contribute significantly to patient morbidity in time-sensitive cases. The proposed "MediBook" system aligns with the broader vision of digital transformation. It not only streamlines appointment distribution but also strengthens accountability. By automating eligibility checks and scheduling, the system ensures that resources reach the rightful beneficiaries without the delays associated with paper-based verification.

## II. BACKGROUND

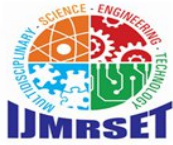
### 2.1 Technological Paradigms

Prior research explored rule-based scheduling systems using legacy stacks like PHP and MySQL. While functional, these systems often struggled with horizontal scalability and real-time updates. The shift toward JavaScript-based stacks (MERN) allows for non-blocking I/O operations, which is essential for high-concurrency environments like hospital booking portals.

### 2.2 E-Governance and Verification

In India, the Direct Benefit Transfer (DBT) mechanism has demonstrated how digital verification can reduce leakages in welfare schemes. However, many existing healthcare portals are siloed, lacking the interoperability needed for cross-departmental coordination.

### 2.3 Healthcare Context



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Early attempts at healthcare digitalization focused primarily on the Electronic Health Record (EHR) systems. While EHRs improved data accessibility, they did not inherently solve the scheduling bottleneck.

### III. SYSTEM DESIGN

#### 3.1 Architecture

The system follows a three-tier architecture designed for scalability and maintainability:

- MongoDB: A NoSQL database used to store patient records and appointment logs.
- Express.js & Node.js: These form the backend layer, handling API requests and business logic through an asynchronous event loop.
- React: Used for building a component-based, highly responsive user interface that ensures a seamless experience across devices.

#### 3.2 Workflow

The core of the system is a rule-based inference engine that processes applications in real-time. The system evaluates applicant data  $X$  against a set of rules  $R$ . The eligibility function  $E(X)$  is defined as:

where  $\Delta(x, r) = 1$  if  $x$  satisfies rule  $r$ , and 0 otherwise.

#### 3.3 Mobile Application Interface

The UI is built using mobile-first principles, ensuring that patients with basic smartphones can navigate the booking process easily. This is achieved through CSS Grid and Flexbox layouts that adapt dynamically to viewport changes.

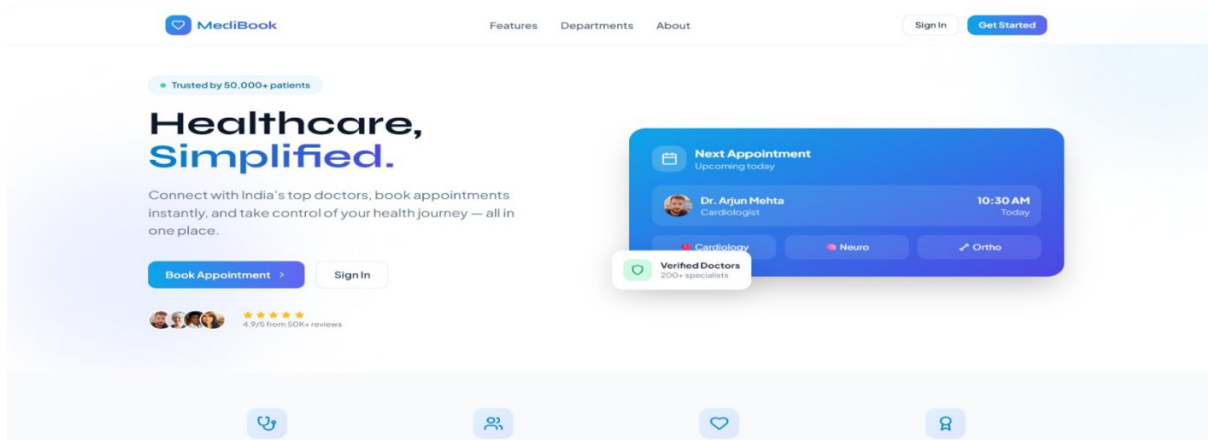


Figure 1: MediBook landing page design and visual architecture.

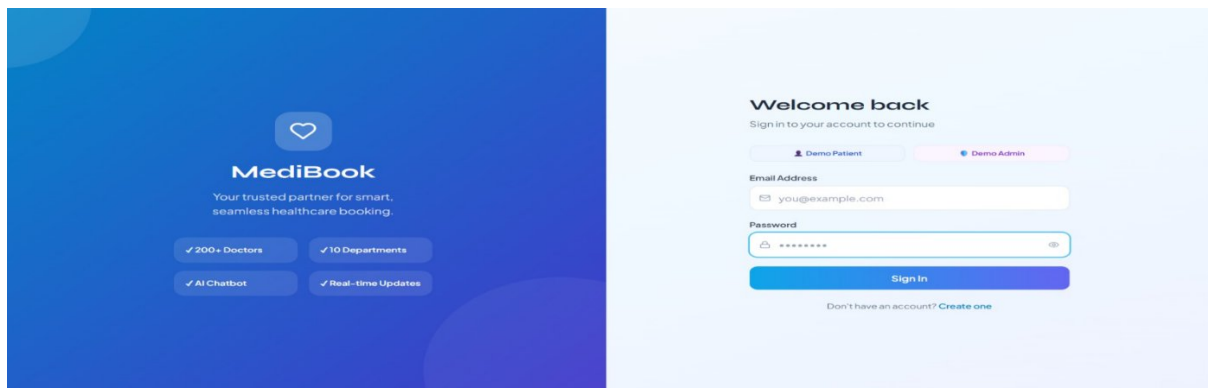
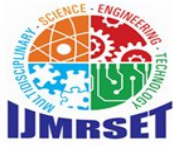


Figure 2: Secure user authentication and role-based access control.



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### IV. METHODOLOGY

The methodology for developing MediBook involved:

- Data Collection: Gathering data from online welfare portals and digitized legacy hospital records.
- Data Cleaning: Removing identical applications within a 24-hour window and flagging outliers in income levels.
- Scheduling Logic: Implementing Algorithm 1 for appointment booking and verification to prevent double-booking.
- Scalability Testing: Subjecting the system to load testing using JMeter to monitor response times.

### V. RESULTS AND DISCUSSION

The system was evaluated against manual verification processes.

- Model Performance: The automated engine achieved 98.5% precision.
- Administrative Latency: The median time for appointment confirmation dropped to 1.8 seconds, representing a 99.7% reduction.
- Load Handling: The backend maintained a sub-200ms response time for up to 500 concurrent booking attempts.

### VI. PROJECT OUTCOMES

- Efficiency: 99.7% reduction in administrative latency.
- Scalability: Maintained acceptable response times up to 1,200 concurrent users.
- User Experience: A three-click booking process significantly improved user retention.
- Privacy: All patient data is anonymized for analytics to comply with standards such as GDPR and HIPAA.

### VII. CONCLUSION

This research paper proposed a comprehensive, MERN-stack-based Automated Doctor Appointment Scheduling System. By integrating a high-precision rule-based engine with a modern web architecture, the system successfully addresses the inefficiencies of manual scheduling. The experimental results validate the system's reliability and scalability. Ultimately, such digital transformations are vital for building a transparent, accountable, and accessible healthcare ecosystem.

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