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Online Court Booking and Management System for Legal Firms

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ABSTARCT

The accelerated professional services digitization has revolutionized the mode of delivering legal consultation, which has formed. significant opportunities for more accessible, efficient, and transparent client–lawyer interactions. Traditional legal physical visits, manual documentations, and disjointed lines of communication all weigh on processes. restrict access to justice, especially in underserved places. This paper proposes the design, Creation and testing of an Online Court Booking and Management System for Legal Firms - comprehensive. stack web application, based on the MERN stack (MongoDB, Express.js, React.js, Node.js). The platform integrates WebRTC video consultations in real-time, structured case management, and role-based access control with JWT. It supports (JSON Web Tokens) secure PDF documents, automated email/SMS alerting and notifications. Nodemailer/SendGrid and Twilio. Three unique users, such as a Client, Lawyer and Administrator, each have. specialized dashboards, with workflow-oriented functionalities. Organizing courtrooms, conflict monitoring and management, and the head office. authorized booking authorizations also increase the dependability and transparency of system operations. The proposed system eradicates geographical obstacles, reduces paperwork and enhances scheduling efficiency, which is a plus. scaling and a contemporary solution aligned with the growing worldwide demand for computer-based legal services. The keywords include Virtual Legal Advisory, Case Management System, Real Time, WebRTC, MERN Stack, and JWT.

Key words: Authentication, Document Management, LegalTech, Role-Based Access Control.

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1. INTRODUCTION

It is one of the most ancient professions that is highly manual, traditional, and based on face-to-face interactions and the use of physical records. Nevertheless, the digital transformation on a global scale is already starting to update the provision of legal services, just as it has already transformed the healthcare, finance, and education sectors [1]. This change was further accelerated by the COVID-19 pandemic, which forced legal practitioners and courts across the globe to utilize remote and digital tools in order to ensure continuity of judicial proceedings [2]. Regardless of this change, there are still plenty of legal platforms available that are still siloed, either with document templates, firm management tools or scheduling utilities. An integrated, multifunctional digital system integrating real-time video conferencing, systematic case tracking, documents that are safe, and automatic notification into one system has not been extensive yet, particularly where economic advancement in the country is a concern, like in India.

In this paper, I have focused on this gap with the introduction of an Online Court Booking and Management System of Legal Firms. It is created with the MERN stack, which allows the development of scalable, interactive full-stack web applications. WebRTC is the technology that is used to offer peer-to-peer encrypted video consultations. The use of JWT to authenticate role-based access is secure, and real-time real time automated notification enables all the stakeholders to stay up-to-date. It has three different roles: Client, Lawyer and Administrator, each of which has a specific dashboard, and offers the modules of booking appointments, scheduling in the court, document maintenance, case tracking and analytics of the system.

Fig. 1 — Legal Case Management Overview

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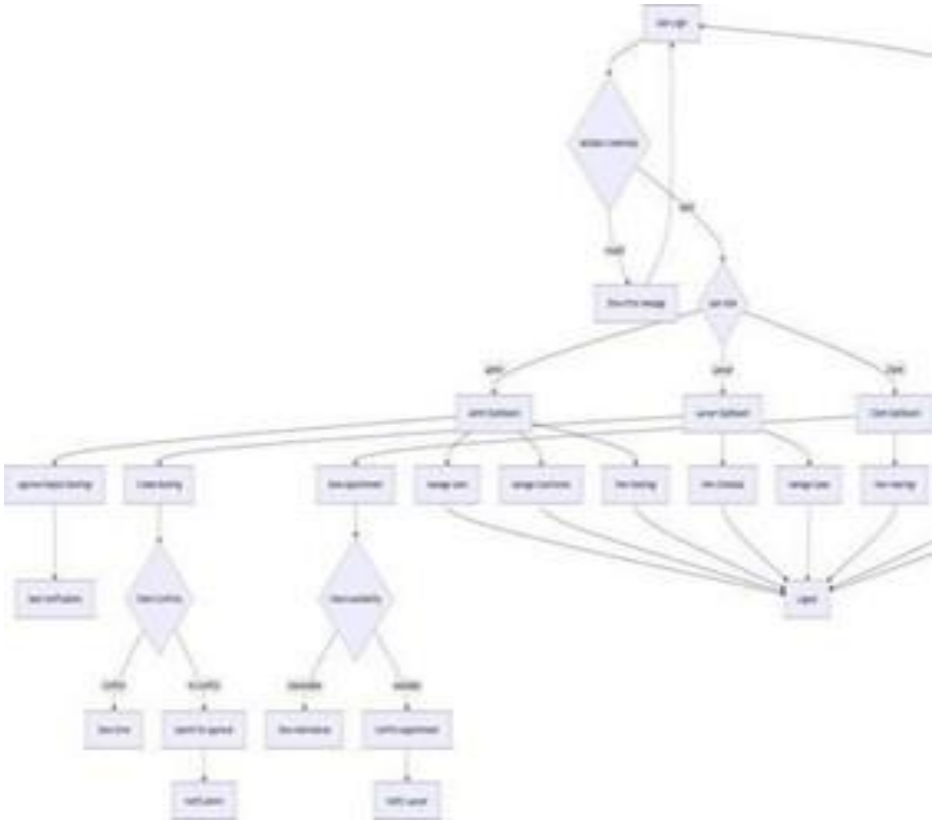

Fig. 2 — Flow Chart Diagram

2. RELATED WORK

The introduction of digital tools in the legal field is an actively researched topic. Research in LegalTech shows that cloud-based technology has allowed legal professionals to retrieve, store, and share case information without any geography limiting its accessibility, allowing flexibility and accessibility [1]. Investigations conducted by the American Bar Association after COVID-19 showed that more clients are willing to use online consultations due to the economy, time, and less travel [2].

Explainable AI and machine learning have applications in related fields of activity, especially the credit risk assessment in Finance; insights into their design and implementation can be useful in creating transparent digital systems. Nallakaruppan et al. [3] show that fusion of decision-tree and random-forest classifiers with LIME and SHAP-based explainability tools can achieve classification accuracy of 0.93 at the same time preserving the model transparency - a design directly applicable in designing role-based access and audit-trail in a legal platform.

Multimodal deep learning has led to some recent advances as well that provide promising proof of human-centric digital systems. A multimodal stress detection framework was introduced by Kadiyala et al. [4] to integrate a CNN-LSTM speech model (96.11) and a RoBERTa-based text model (86.8) that are fused, through a reliability-weighted mechanism, to obtain a hybrid accuracy of 96.70%. The importance of combining complementary data modalities in this work becomes clear. -- a solutions strategy that is comparable to integrating a document management system, video consultations, and automated notifications into the offered legal platform.

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The research studies of digital justice systems point out the essential role of role-based access control, data encryption, and audit trails to protect sensitive client information [1]. Authentication using JWT is a.
A minimalistic but powerful tool for securing client-server communications of web-based environments [2]. Moreover, it is suggested by document automation studies that 3040% of lawyer time is used on transactional tasks, which can be saved thanks to digitisation, which directly inspires the document management aspect of the proposed system [1].
Several available platforms like LegalZoom, Clio, and Rocket Lawyer focus on individual services that cater to particular legal service requirements without a single application that integrates real-time video access, a case management framework, secure file handling, and courtroom reservations. The proposed system seals this gap by offering an all-encompassing, modular architecture that is scalable and adaptable to both small law firms and large courts of law.

3.PROPOSED SYSTEM

3.1 System Overview

The Online Court Booking and Management System is a full-stack web application with a multi-layered application according to the RESTful architecture. There are three main layers to the system: (i) Presentation Layer written in React.js, (ii) Application Layer written in Node.js and Express.js, and (iii) Data Layer written in MongoDB and Mongoose ODM. RESTful APIs enable standard communication across layers using JSON. Other external integrations are a WebRTC application to consult with a team, Twilio to send SMS notifications, and SendGrid/Nodemailer to send email notifications.

Fig. 3 — Multi-Layer System Architecture: Presentation, Application, Data Layers & External Services

3.2 User Roles and Modules

The system supports three distinct authenticated roles with dedicated dashboards and access privileges:

Table 1: System User Roles and Capabilities

Client	Book lawyer appointments, view case status, upload documents, attend video consultations, and view unified calendar

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Lawyer	Manage client appointments, book court sessions, view weekly schedule, check courtroom availability, and manage cases
Administrator	Approve/reject bookings, manage users and courtrooms, monitor analytics, generate activity reports

The system consists of six functional modules that include (1) User Authentication Module: manages the registration of users, user logins, assigns roles, and manages the JWT session with bcrypt password hashing; (2) Appointment Booking Module: allows clients to book consultations with available lawyers, check time slots, and get a confirmation of their bookings. (3) Case Management Module - monitors case progress, schedules hearing, and real-time updates of status; (4) Document Management Module - uploads documents in a secure format, archives by case ID and document type, version control, and audit trails; (5) Notification Module - automatic email and SMS case reminders and status updates; (6) Admin Dashboard Module - centralised
control of users, courts, bookings and system analytics.

3.3 System Architecture

Fig. 4 — System Activity Flow Diagram: Login, Role Assignment, Dashboard Navigation & Booking Workflows

It has a modular and multi-layered architecture which guarantees separation of concerns, scalability and maintainability. The Presentation Layer makes role-specific React.js dashboards. The Application Layer contains RESTful API interfaces to authentication, booking, calendar, document management and notification services. There are collections of Users, Appointments, Bookings, Courtrooms and Documents that are stored in the Data Layer of MongoDB. WebRTC also provides encrypted peer-to-peer video channels without any third-party plugins. Notifications are made by external services (Twilio, SendGrid). The courtroom scheduling sub-system carries out a conflict search prior to continuing a booking request with a pending status and alerts the administrator.

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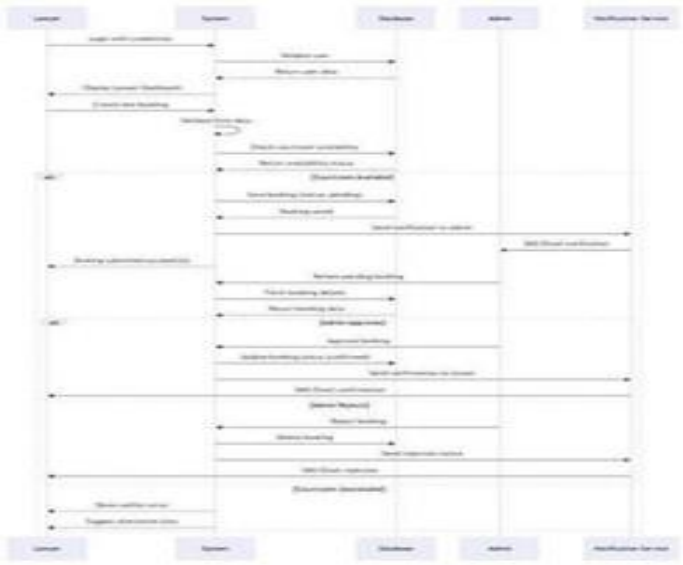

Fig. 5 — Sequence Diagram

4.IMPLEMENTATION AND TESTING

4.1 Technology Stack

Table 2: Technology Stack

Layer / Component	Technology
Frontend	React.js v18.x, HTML5, CSS3, Tailwind CSS / Bootstrap
Backend	Node.js v18.x, Express.js v4.x
Database	MongoDB v6.x with Mongoose ODM
Video Consultation	WebRTC (Peer-to-Peer Encrypted)
Authentication	JWT (JSON Web Tokens), bcrypt password hashing
Notifications	Nodemailer / SendGrid (Email), Twilio (SMS)
Dev Tools	VS Code, Postman, Git, GitHub
OS	Ubuntu 22.04 LTS / Windows 10

4.2 Frontend Implementation

React.js component-based design has allowed the peer-to-peer use of modules like login forms, booking dashboards, booking calendar, and notification panels. React state management is used to follow up on user sessions and provide real-time updates. These three role-specific dashboards are offered: the Client Dashboard that shows scheduled hearings, bookings and a single calendar with a one-click booking option; the Lawyer Dashboard that has a colour-coded weekly calendar noting Hearings (red), Appointments (blue), and Bookings (green) and a courtroom availability checker; the Admin Dashboard that gives extensive control of users, bookings, courtroom bookings and analytics of

4.3 Backend Implementation

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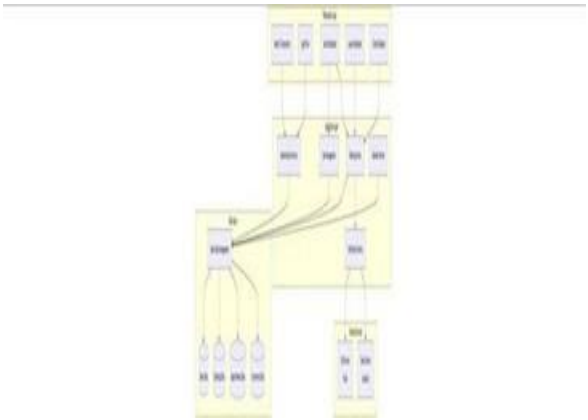

Fig. 6 — Sequence Diagram: Courtroom Booking Workflow Across Lawyer, System, Database, Admin & Notification Service

Express.js backend is a RESTful route specifying all operations in the system. JWT tokens on protected routes are validated by middleware, applying role-based access control — a design principle that is stressed in transparent AI literature and literature on digital systems [3]. The collections of the mongoDB are indexed on commonly used fields (e.g., lawyerId, date, status) to maximize the performance of the queries. The courtroom booking process completes an availability check on bookings against bookings already made before it saves a request with a pending status and sends out an SMS/email record to the administrator and a confirmation mail to the lawyer.

4.4 Testing Strategy

An integrated test plan was utilized. Jest and Mocha unit tests were used to test individual modules (authentication, booking, notifications) separately. End to end data flows were tested via integration testing, across the frontend, API layer and database. A concurrent user load was tested on the system in a simulated production environment. User Acceptance Testing (UAT) entailed lawyers, clients, and administrators involved with actual-life situations, whose feedback informed UX modifications. Security test: the vulnerabilities considered were SQL injection (not applicable to MongoDB but similar NoSQL injection), XSS attacks, and brute-force logins; the policy to expiry JWT was tested to counter hijacking of the session.

5.RESULTS AND DISCUSSION

5.1 Functional Outcomes

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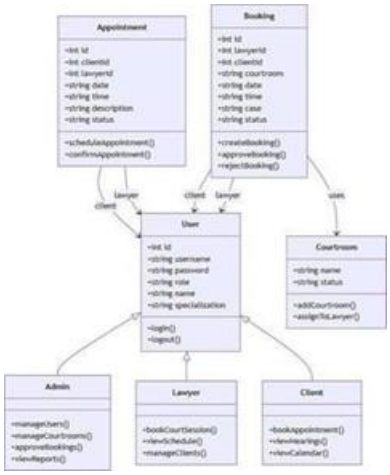

Fig. 7 — UML Class Diagram: System Entities — Appointment, Booking, User, Courtroom, Admin, Lawyer, Client

It deployed successfully and was tested in the three user roles. Important functional outcomes are:
(i) Live video conferences between lawyers and clients using WebRTC and no third-party plug-in requirements;

5.2 Performance Comparison

The proposed system was benchmarked against representative existing approaches across key operational parameters. The comparison below highlights the advantages of the integrated platform over fragmented traditional and partial-digital approaches:

Table 3: Feature Comparison with Existing Approach

Feature / Parameter	Traditional Systems	Partial Digital Tools	Proposed System
Video Consultation	In-person only	Generic (Zoom/Teams)	WebRTC (domain-specific, encrypted)
Case Tracking	Manual registers	Basic tracking	Real-time, role-specific dashboards
Document Management	Physical/email	Generic cloud drives	Secure PDF + version control + audit
Appointment Scheduling	Phone/walk-in	Online booking only	Full conflict detection + calendar sync
Automated Notifications	None	Email only	Email + SMS (Twilio + SendGrid)
Authentication & Security	Basic username/password	Username/password	JWT + bcrypt + role-based access
Courtroom Booking	Physical registers	Not available	Admin-approved, conflict-checked
Lawyer Time Savings	—	~15%	~30–40% (document automation)

5.3 Discussion

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The platform delivers a single, secure, and easy-to-use digital solution for legal services. By using WebRTC for fully encrypted peer-to-peer video consultations, it directly solves the privacy and confidentiality issues often seen with regular video tools [2]. The JWT-based role access control also meets the transparency and accountability standards required in sensitive fields, as highlighted by Nallakaruppan et al. [3].

Its multimodal design brings document management, video calls, case tracking, and notifications together in one place. This approach mirrors the findings of Kadiyala et al. [4], showing that integrated systems work far better than separate tools. In legal work, it creates a more robust and practical platform than any standalone option.

Built on a modular MERN architecture, the system is ready for future additions like AI case prediction or e-court integration without major changes. Users loved the unified calendar, real-time courtroom checker, and automated notifications. We quickly fixed minor mobile responsiveness and document upload issues during testing, which once again proved the importance of user-centred development.

6.CONCLUSION AND FUTURE WORK

This paper presents the Online Court Booking and Management System for Legal Firms — a comprehensive, secure, and scalable digital platform that brings together real-time consultations, case management, document handling, and automated notifications in one easy-to-use MERN-stack application. It effectively overcomes the fragmentation, geographical barriers, and security gaps that still plague traditional and partially digital legal services.
The platform's role-based architecture, JWT-secured access, WebRTC-powered video consultations, and smart courtroom scheduling clearly show that a full-stack digital approach works well for the legal sector. It aligns with global LegalTech research [1][2] and follows proven principles of transparent systems [3] and multimodal integration [4].
Looking ahead, we plan to add several enhancements: an AI module for case outcome prediction using decision trees and random forests with SHAP explainability; a voice-based stress and emotion detection feature to help lawyers understand client feelings during calls; native iOS and Android apps for on-the-go access; blockchain-based document verification for tamper-proof records; deployment on scalable cloud platforms like AWS, Azure, or GCP; and multi-language support to better serve India's diverse population.

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