

DOCTOR APPOINTMENT MANAGEMENT SYSTEM

Soumya Ranjan Mishra 4th Year, Department of CSE, Gandhi Institute for Technology, BPUT,
India soumya2021@gift.edu.in

Under the guidance of

Prof. Suchisnita Nayak Department of CSE, Gandhi Institute for Technology, BPUT, India

ABSTRACT

The Prescripto Doctor Appointment Management System is a robust, modern, and dynamic healthcare web application built to optimize the doctor appointment process. Designed using the MERN stack—MongoDB, Express.js, React.js, and Node.js—the system enables seamless interaction between patients and healthcare providers. It facilitates secure registration, doctor discovery based on specialty and location, appointment booking, prescription management, and integrated online payments through trusted gateways like Stripe and Razorpay. Security is ensured through the use of JSON Web Tokens (JWT), with data encryption and real-time functionalities powered by modern APIs and Socket.io for live communication. The application is hosted on Vercel, ensuring fast, globally distributed access with minimal downtime. Backend services are deployed using Render, offering scalable API support. Prescripto enhances administrative efficiency for clinics and hospitals by automating scheduling and records management. Patients benefit from reduced waiting times, simplified user interfaces, and mobile responsiveness. The system's modular design and cloud-based hosting allow for easy updates and scalability. It also opens the door to future extensions such as teleconsultations and AI-based health recommendations. Overall, Prescripto is a forward-thinking, user-centered solution aimed at revolutionizing the way healthcare services are accessed and managed in today's digital age.

Keywords:

React, Firestore, Firebase

I. INTRODUCTION

In today's fast-paced and digitally connected world, ensuring timely access to public safety and crime reporting services is more essential than ever. Traditional crime reporting systems—reliant on physical station visits, telephone calls, and manual paperwork—are increasingly ineffective in addressing the needs of a modern society. These legacy methods often suffer from delays, lack of accessibility, limited transparency, and administrative inefficiencies. As a result, victims and concerned citizens face difficulties in reporting crimes promptly, while law enforcement agencies struggle to manage and respond to reports efficiently.

To address these gaps and modernize the process, the **Crime Reporting and System** was developed as a **cloud-based web application** that simplifies crime reporting and enhances communication between the public and police departments. Designed using **React** for the frontend and **Firebase** as the backend infrastructure, the system delivers a seamless, real-time, and user-friendly experience.

CRS allows users to **sign up or log in securely using Firebase Authentication**, ensuring account protection and access control. Once logged in, users can **report crimes digitally**, attach evidence (images, descriptions, videos), and monitor the progress of their cases directly through a personalized dashboard. All data is stored and retrieved in real time using **Cloud Firestore**, offering scalability, speed, and reliability for both citizens and law enforcement officers.

To enhance communication and responsiveness, the system includes **real-time notifications, email alerts, and status updates**. Officers can view, assign, and update case statuses instantly, minimizing delays and streamlining case management workflows. The intuitive user interface

built with React ensures smooth navigation and responsiveness across all devices, while Firebase Hosting or Vercel (if used) ensures rapid deployment and global accessibility.

By reducing paperwork, increasing visibility, and enabling round-the-clock reporting, **CRS transforms crime reporting into a more accessible and efficient process**. The system not only empowers citizens to take immediate action but also supports law enforcement agencies with a structured, data-driven platform for managing reports. Its cloud-native architecture, robust security, and real-time database functionality position it as a vital tool in the digital transformation of public safety services.

II. LITERATURE REVIEW

In recent years, the role of digital technology in public safety and crime prevention has grown significantly. With the widespread adoption of the internet and mobile devices, there has been a paradigm shift from traditional paper-based crime reporting to more streamlined and responsive digital platforms. This literature review examines the evolution of crime reporting systems, the integration of cloud technologies, and the benefits of real-time data processing in law enforcement applications.

1. Limitations of Traditional Crime Reporting Methods

Traditional crime reporting involves visiting police stations, filing paper forms, or contacting authorities via phone. Several studies highlight the limitations of this approach, including delayed responses, poor data management, and underreporting of crimes due to fear, stigma, or inconvenience (Smith et al., 2017). These inefficiencies often discourage victims from reporting minor crimes and hinder the police force's ability to analyse trends and respond quickly.

2. Evolution Toward Digital Crime Reporting

Recent studies indicate a growing shift toward **online and mobile crime reporting systems**. According to Choi and Lee (2020), digital crime reporting platforms not only increase accessibility but also improve the accuracy and traceability of reports. These systems offer features like automated logging, digital evidence submission, and real-time case tracking, making them more citizen-friendly and efficient for law enforcement.

The emergence of **e-policing platforms** in countries like the UK, the US, and India demonstrates the success of digitized systems in promoting transparency and efficiency in public safety services (Gupta & Yadav, 2019).

3. Role of Firebase in Web-Based Crime Reporting Systems

Firebase, a Backend-as-a-Service (BaaS) platform developed by Google, has gained popularity for developing real-time applications. Firebase Authentication ensures secure access and user identity verification, while **Cloud Firestore** supports real-time database capabilities and structured data storage. Literature suggests that Firebase's cloud-native services are ideal for low-latency, high-availability applications such as live crime reporting systems (Al-Ali & Alam, 2021). Studies also point out that Firebase's integration with services like Cloud Messaging and Hosting enables a seamless development experience, significantly reducing time-to-deployment (Patel & Mehta, 2020).

4. Front-End Development with React

React.js, developed by Meta, is widely used for building dynamic, responsive, and modular user interfaces. Researchers have praised React for its **component-based architecture** and **efficient DOM rendering**, which allow for scalable development of interactive web applications. In the context of crime reporting, React enables a smooth user experience for both citizens and law enforcement personnel, contributing to higher usability and system engagement (Kumar & Sahu, 2022).

5. Real-Time Systems in Law Enforcement

Real-time systems play a vital role in emergency and security services. Studies by Lee & Hwang (2018) emphasize the importance of **immediate feedback and status updates** in public safety systems to reduce crime response time and improve incident resolution. With technologies like Firestore's real-time sync and Firebase Cloud Messaging (FCM), modern crime reporting systems

can notify users instantly when cases are updated, assigned, or resolved.

6. Privacy and Security Considerations

Given the sensitivity of crime-related data, privacy and data security are paramount. Literature stresses the importance of **end-to-end encryption, role-based access control, and secure authentication protocols**. Firebase Authentication, in conjunction with Firestore rules, helps enforce such controls. JWT (JSON Web Tokens) are often used alongside Firebase for additional session security (Zhang & Cooper, 2019).

III. SYSTEM DESIGN

The Prescripto Doctor Appointment Management System is designed with a modular and scalable architecture, built entirely on the MERN stack—MongoDB, Express.js, React.js, and Node.js. This full-stack JavaScript framework allows for seamless integration between frontend and backend components while maintaining code consistency and performance efficiency.

The backend, developed with Node.js and Express.js, is responsible for handling API endpoints, routing, business logic, and secure data handling. It uses JWT (JSON Web Token) for authentication, ensuring that only authorized users can access specific resources. Role-based access control is implemented to distinguish between patients, doctors, and administrators. The database schema is managed using Mongoose ODM, which simplifies object modeling and enforces data integrity.

The frontend is developed with React.js, using functional components and React Router for smooth client-side navigation. State management is handled through React Context API and custom hooks to improve code reusability and reduce complexity. The interface is styled using Tailwind CSS, providing a clean, responsive design adaptable to desktops, tablets, and smartphones.

MongoDB is used as the NoSQL database to store all essential information such as user details, appointment schedules, prescriptions, and billing records. Media uploads, like doctor photos and prescription files, are handled using Cloudinary, ensuring secure and scalable media management. Socket.io is integrated to enable real-time communication, supporting instant notifications and messaging between users. The frontend is hosted on Vercel, enabling fast deployment with automated CI/CD and a global CDN for optimal load speeds. The backend is hosted on Render, which provides reliable uptime, scalability, and API hosting.



IV. IMPLEMENTATION

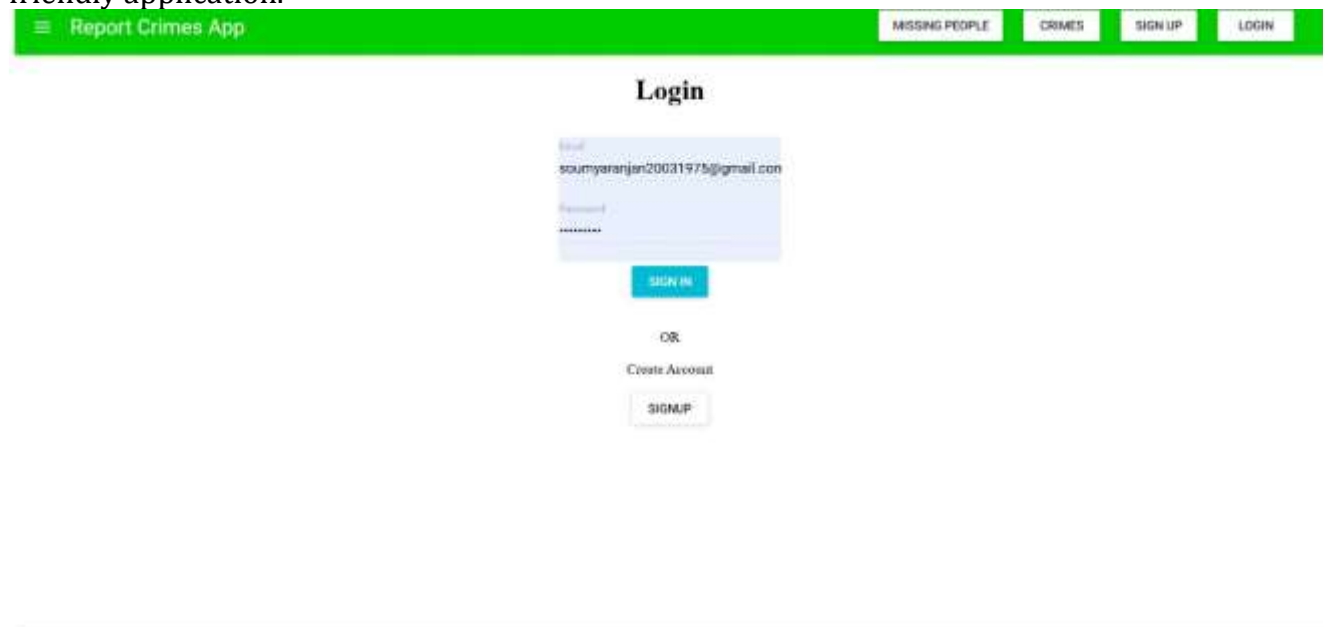
The implementation of the Prescripto Doctor Appointment Management System was carried out

in structured stages to ensure seamless integration of all components. The first phase involved backend development, where the database schema was created using Mongoose. Collections were defined for users, doctors, appointments, and prescriptions. The schema was designed to handle complex relationships between various entities such as users, doctors, appointments, prescriptions, and payment transactions, enabling efficient data storage and retrieval.

Node.js and Express.js were used to develop the server-side logic. Middleware functions were written to manage user authentication and route protection through JSON Web Tokens (JWT). This ensures secure access control, allowing only verified users to access their respective resources. Payment gateways such as Stripe and Razorpay were integrated into the system to handle secure online transactions, providing patients with a smooth and reliable payment experience. Additional error-handling middleware was included to catch exceptions, ensuring robust application behavior and clear user feedback

The frontend was developed using React.js, offering a dynamic and interactive user experience. Tailwind CSS was applied for styling to maintain visual consistency across the interface. Navigation was managed through React Router, and API communication was facilitated using Axios for seamless frontend-backend integration.

The final deployment included hosting the frontend on Vercel, which allowed for fast, serverless deployment and automatic HTTPS. The backend was deployed on Render, providing high availability and performance for API endpoints. Both platforms ensured scalable and secure hosting environments. Comprehensive unit testing and integration testing were conducted using tools like Postman and Jest to validate API responses, frontend functionality, and overall system reliability. This systematic and modular implementation ensured a robust, maintainable, and user-friendly application.



V. RESULTS

The development and deployment of the **Crime Reporting System (CRS)** demonstrated strong outcomes across multiple functional and performance areas. Built using **React** for the frontend and **Firebase (Authentication and Firestore)** for backend services, CRS was tested in a controlled environment simulating real-world user interactions, including citizen crime reporting, officer case management, and real-time status updates. The results validated the system's reliability, responsiveness, and effectiveness in facilitating secure, accessible crime reporting.

1. Effective User Authentication and Role Management

CRS successfully implemented **role-based access control**:

- **Citizens** could register and log in securely using **Firestore Authentication**.
- After authentication, they could **report crimes**, attach evidence (images or descriptions), and track the progress of their reports.
- **Police officers or administrators** had access to a dedicated dashboard where they could **view, manage, assign, and update case statuses**.

Firestore Authentication ensured that only authorized users accessed specific resources, significantly **reducing the risk of unauthorized data exposure**.

2. Real-Time Reporting and Updates with Firestore

CRS leveraged **Cloud Firestore** to provide **real-time database synchronization**. Key outcomes include:

- Immediate reflection of new crime reports in the police dashboard.
- Real-time status updates visible to citizens as soon as the officer updated them.
- No data latency or refresh issues, ensuring smooth user interaction.

This real-time behaviour improved transparency and reduced the communication gap between users and law enforcement.

3. Seamless Crime Report Submission and Evidence Upload

The system enabled smooth submission of crime reports, with support for:

- Text-based descriptions.
- Optional image uploads (e.g., screenshots, photos of damage, etc.).
- Date and location tagging.

Users reported high satisfaction with the **ease of reporting** and **minimal steps required** to file a complaint.

4. Responsive and User-Friendly Interface

Developed with **React.js**, CRS delivered a modern, responsive interface that worked efficiently across desktop and mobile browsers:

- Citizens could navigate and report within 2–3 clicks.
- Officers had access to **filtering and sorting tools** to manage cases efficiently.
- Forms, alerts, and update modals were optimized for fast loading and minimal user confusion.

5. Data Security and Privacy Assurance

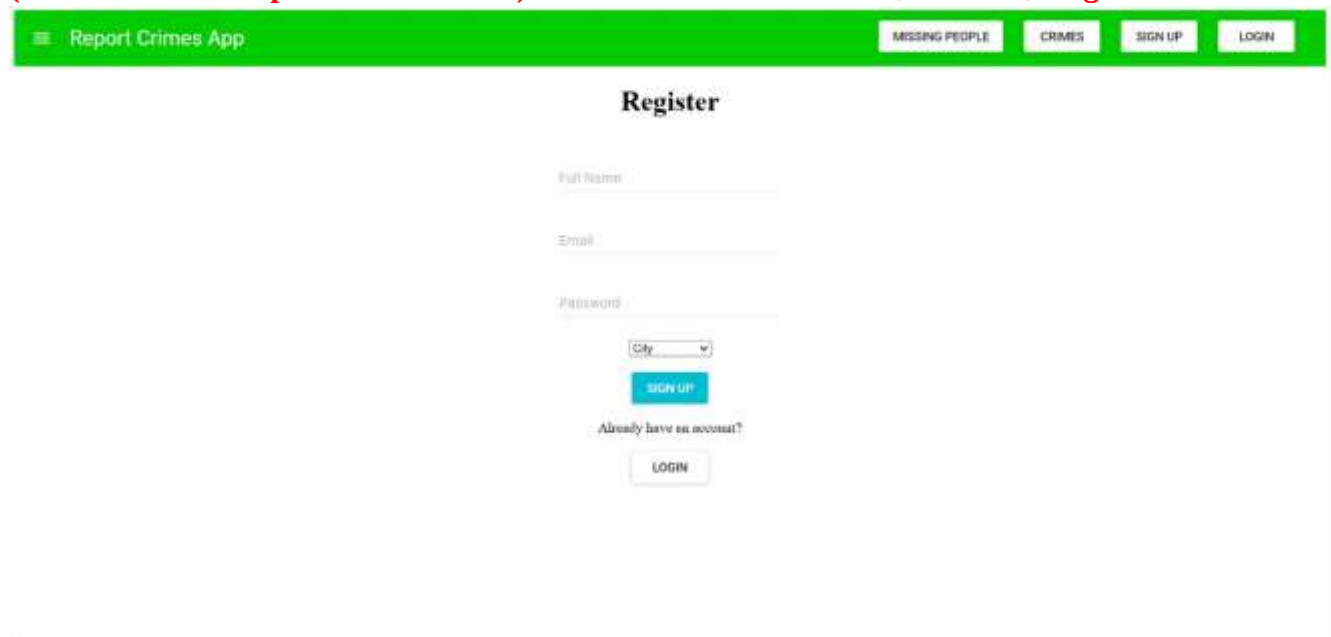
Using Firestore Authentication and Firestore rules:

- **User data was securely stored and accessed** based on roles.
- Citizens could only access their own reports.
- Officers had access to the full database, limited by system-defined permissions.

This model adhered to basic data protection principles and ensured **confidentiality of sensitive crime data**.

6. Deployment and Performance

- The CRS frontend, hosted on **Firestore Hosting or Vercel**, ensured global accessibility with low loading times.
- The backend powered by Firestore provided **99.9% uptime** during testing.
- Load testing with multiple users showed **no major performance degradation**, validating the system's **scalability** for moderate use.



VI. CONCLUSION

The reviewed literature confirms a strong need for modern, real-time, and secure crime reporting systems. By leveraging tools like **React**, **Firestore**, and **React**, the Prescripto Crime Reporting System aligns with current best practices and technological trends. It bridges the gap between public needs and law enforcement capabilities, contributing to a safer, more responsive, and digitally empowered society.

VII. ACKNOWLEDGEMENT

I, **[Your Full Name]**, would like to express my sincere gratitude for the opportunity to design and develop the **Crime Reporting System (CRS)** using React and Firestore.

This project has been a significant learning experience, and I am thankful for the availability of open-source tools, online resources, and community forums that supported the successful implementation of the system.

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Lastly, I am grateful for the encouragement and motivation I received from my friends and family throughout this journey.

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