IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Digital Supply Chain Transformation And Supply Chain

Rizwan Ahamed Z
Department of Computer Science and Business Systems,
K.Ramakrishnan College of Engineering, Trichy, Tamil Nadu, India

Mothiswaran P
Department of Computer Science and Business Systems,
K.Ramakrishnan College of Engineering, Trichy, Tamil Nadu, India

Suraj Selvam P
Department of Computer Science and Business Systems,
K.Ramakrishnan College of Engineering, Trichy, Tamil Nadu, India

M.Karthika, M.E.,
Assistant Professor, Computer Science and Business Systems
K Ramakrishnan College of Engineering, Trichy Tamil Nadu, India

Abstract: In the modern supply chain ecosystem, real-time inventory tracking plays a crucial role in ensuring product availability, optimizing stock levels, and enabling accurate demand forecasting. This project presents a lightweight, real-time inventory tracking application specifically designed for manufacturers to monitor product sales directly from retail outlets such as supermarkets.

Using QR codes, barcodes, IoT sensors, and cloud-based synchronization, the system enables instant logging and monitoring of inventory movement. The application is developed using HTML, CSS, JavaScript, and Firebase Firestore for real-time database management. The system improves operational efficiency, reduces manual errors, and provides live dashboards and alerts for stock monitoring. Compared with traditional ERP systems, the proposed system offers a cost-effective, scalable, and user-friendly solution suitable for SMEs and rural industries.

The design prioritizes affordability, simplicity, and accessibility, making it suitable for small and medium-scale enterprises (SMEs), especially in rural and semi-urban markets where costly ERP systems like SAP are impractical .By eliminating manual data entry delays and providing live sales visibility, the solution enables accurate stock predictions, faster replenishment, and improved decision-making. Compared to large-scale ERP solutions, this project offers a focused, product specific, and mobile-friendly approach, bridging the gap between traditional stock books and enterprise-level inventory management systems.

Keywords- Digital Supply Chain, Inventory Tracking, Firebase, QR Code, Barcode Scanning, IoT Sensors, Cloud Database, Real-Time Monitoring, Supply Chain Analytics.

I. INTRODUCTION

The proposed system is a Cloud-Based, IoT-Enabled, Real-Time Inventory and Supply Chain Management System designed to digitize and automate the complete flow of materials, information, and operations within a supply chain. Traditional supply chains rely heavily on manual entries, paper-based documentation, and delayed communication, resulting in inefficiencies and frequent errors. To overcome these limitations, the system integrates modern digital technologies to provide seamless connectivity, real-time visibility, and automated decision support.

This system uses cloud computing as the central platform for data storage, synchronization, and dashboard access, enabling users to monitor supply chain activities from any location. IoT sensors are incorporated to capture real-time data such as stock levels, movement, and environmental conditions, reducing the need for manual intervention. Additionally, QR/Barcode scanning is used to ensure accurate identification of items at every stage, improving tracking and traceability.

I.1. Abbreviations and Acronyms

- **QR – Quick Response Code**
- **API - Application Programming Interface**
- **SDK - Software Development Kit**
- **HTTPS - Hypertext Transfer Protocol Secure**
- **IoT – Internet of Things**

I. Problem Statement

The traditional healthcare system relies heavily on manual and fragmented processes for appointment scheduling, patient record management, consultation, and prescription handling, which often leads to long waiting times, data inconsistency, limited accessibility, and inefficient coordination between patients, doctors, and healthcare administrators. Patients face difficulties in finding suitable doctors, managing medical records, and accessing timely consultations, while doctors struggle with maintaining organized patient data and managing schedules effectively. The absence of a centralized digital platform further restricts remote healthcare services, real-time communication, and administrative monitoring. These challenges highlight the need for an integrated, secure, and scalable digital healthcare management system that streamlines healthcare operations, improves accessibility, and enhances the overall quality of medical services.

II. Background of the Project

The rapid growth of digital technologies and increasing demand for efficient healthcare services have highlighted the limitations of traditional healthcare systems that rely on manual processes and disconnected platforms. Conventional methods of appointment scheduling, patient record maintenance, and doctor–patient communication often result in delays, data loss, limited accessibility, and increased administrative workload. With the rise of telemedicine, electronic health records, and location-based services, there is a growing need for a centralized digital solution that integrates these functionalities into a single platform. This project addresses these challenges by developing a digital healthcare management system that leverages modern web technologies to enhance healthcare accessibility, improve operational efficiency, and support seamless interaction between patients, doctors, and administrators in a scalable and technology- driven environment.

III. Objective

The primary objective of this project is to design and develop an integrated digital healthcare management system that streamlines appointment scheduling, patient record management, doctor–patient communication, telemedicine, and administrative monitoring through a centralized platform. The system aims to improve healthcare accessibility, reduce manual workload, enhance data accuracy, and support real-time medical consultations using modern web technologies. By leveraging a scalable MERN stack architecture, the project seeks to provide secure, efficient, and user-friendly healthcare services for patients, doctors, and administrators while promoting continuity of care and technology-driven healthcare delivery.

IV. Scope of Project

The scope of this project covers the development of a digital healthcare management system that enables patients to register, manage profiles, book appointments, access medical records, receive prescriptions, and participate in online consultations, while allowing doctors to manage patient data, generate prescriptions, view reports, and conduct telemedicine sessions. The system also includes an administrative module formonitoring platform usage and healthcare statistics. It integrates external services such as geolocation-based pharmacy search, cloud-based medical report storage, email notifications, and virtual meeting APIs. The project focuses on delivering a scalable, modular, and user-friendly solution using modern web technologies, while excluding advanced security mechanisms, insurance processing, and hospital- specific billing systems, which may be considered for future enhancements.

V. Proposed Systems

The proposed system is an integrated digital healthcare management platform designed to automate and centralize healthcare operations such as appointment scheduling, electronic medical record management, digital prescription generation, diagnostic report sharing, telemedicine consultations, and administrative monitoring. Developed using the MERN stack, the system provides dedicated interfaces for patients, doctors, and administrators, enabling efficient doctor–patient interaction, real-time online consultations, and centralized data access. By reducing manual processes and improving accessibility, accuracy, and efficiency, the proposed system supports modern, scalable, and technology-driven healthcare delivery.

VI. Architecture Diagram

The architecture of the proposed healthcare management system is based on the MERN stack and follows a layered, modular design to ensure scalability and maintainability. The presentation layer is developed using React.js and provides separate dashboards for patients, doctors, and administrators. This layer handles user interaction, form validation, and data visualization. User requests from the frontend are transmitted to the backend through RESTful APIs. The application layer, implemented using Node.js and Express.js, processes these requests by handling authentication, appointment scheduling, prescription generation, report management, and business logic.

The data layer uses MongoDB with Mongoose to store healthcare information in a structured and normalized format, including patient profiles, doctor details, appointments, prescriptions, and diagnostic reports. The backend also integrates external services such as telemedicine meeting APIs for virtual consultations, geolocation services for pharmacy location tracking, Cloudinary for secure medical image uploads, and Nodemailer for email notifications. This architecture enables seamless communication between components, supports real-time healthcare services, and provides a robust foundation for efficient, technology-driven healthcare management.

The modular separation of frontend, backend, and data layers allows the system to achieve clear separation of concerns, making development, testing, and future enhancements more efficient. Each module operates independently while communicating through well-defined APIs, reducing system complexity and improving maintainability. This architectural approach also supports scalability, enabling the system to handle an increasing number of users and data without major structural changes. By integrating third-party

services through secure interfaces, the system remains flexible and extensible, ensuring reliable performance and long-term adaptability in real-world healthcare environments.

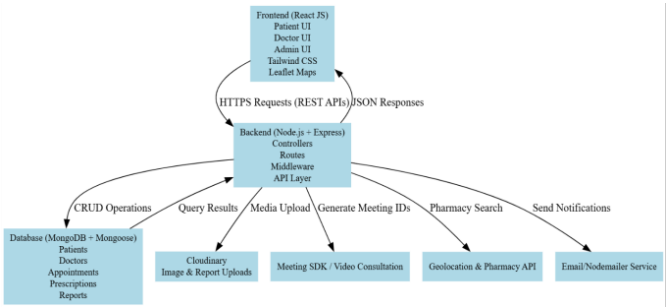

Figure: System Architecture Diagram

VIII Module Description

I.1. Patient Module:

The Patient Module enables users to register, manage their health profiles, book appointments, join online consultations, and access digital prescriptions and diagnostic reports. It improves healthcare accessibility and continuity of care by providing centralized, user- friendly medical services.

I.2. Doctor Module :

The Doctor Module allows doctors to manage patient records, view medical histories and reports, generate digital prescriptions, and conduct online consultations. It streamlines clinical workflows and improves efficiency through centralized digital tools.

I.3. Admin Module :

The Admin Module provides a centralized dashboard to monitor the entire healthcare system, including registered patients, doctors, appointments, and reports. It supports effective system oversight, data tracking, and administrative decision-making.

I.4. Appointment Module :

The Appointment Module enables patients to book, view, and manage appointments based on doctor availability while preventing scheduling conflicts. It automates appointment tracking for both doctors and patients, improving efficiency and reducing manual coordination.

I.5. Payment Module :

The Payment Module facilitates secure and seamless processing of consultation fees and service charges through digital payment methods. It records transaction details and ensures transparent, reliable payment management for patients and healthcare providers.

I.6. Notification Module :

The Notification Module sends automated alerts and reminders for appointments, consultations, payments, and report updates via email or in-app notifications. It ensures timely communication and keeps users informed about important healthcare activities.

IX Methodology / Working Process

The methodology of the proposed healthcare management system follows a structured development approach using the MERN architecture. The process begins with user registration and authentication, where patients, doctors, and administrators access role-specific dashboards. The frontend, developed using React.js, captures user inputs and interactions, which are sent to the backend through RESTful APIs. The Node.js and Express.js backend handles request validation, business logic, and data processing, while MongoDB stores and manages patient profiles, doctor information, appointments, prescriptions, and reports in a structured format.
Once authenticated, patients can search for doctors, book appointments, and join online consultations. Doctors can review patient details, update medical records, generate prescriptions, and upload diagnostic reports. The system integrates external services such as telemedicine APIs for virtual consultations, geolocation APIs for pharmacy search, Cloudinary for medical image storage, and email services for notifications. This end-to-end workflow ensures efficient data flow, real-time communication, and seamless healthcare service delivery while maintaining scalability and modularity.

X Tools & Technologies

The project uses modern web technologies to develop an integrated digital healthcare management system, with React.js for the frontend to create dynamic and responsive user interfaces, Tailwind CSS for styling, and supporting libraries for routing and geolocation features. The backend is built using Node.js and Express.js to implement RESTful APIs, while MongoDB with Mongoose handles data storage and modeling. Additional tools such as telemedicine meeting APIs for virtual consultations, Cloudinary for secure medical report storage, Nodemailer for email notifications, and geolocation APIs for pharmacy location services enhance the system's functionality and scalability.

XI Advantages

The proposed healthcare management system offers several advantages, including centralized digital access to patient records, appointments, prescriptions, and reports, which reduces paperwork and manual errors. Telemedicine features improve healthcare accessibility for remote patients, while automated scheduling and notifications enhance efficiency for doctors and administrators. The system's scalable MERN architecture supports future expansion, improves data accuracy, and enables secure, efficient, and technology- driven healthcare service delivery.

XII Limitations

The system has certain limitations, including basic security mechanisms that lack advanced features such as multi-factor authentication, role-based access control, and encryption at rest. Dependence on third-party APIs for telemedicine, payments, and geolocation may affect availability during outages or rate limits. Additionally, performance may degrade with large data volumes or on low-bandwidth devices, and further optimization is required to support large-scale, real-world healthcare deployments.

XIII Future Enhancment

The future enhancement of this system envisions a unified digital healthcare ecosystem that streamlines and automates consultation, payment, and reporting processes, significantly reducing manual work and delays in patient care. Its potential includes AI-driven diagnostic suggestions, integration with wearable health devices, and the capability to scale into a national telemedicine platform, creating a more efficient, accessible, and technology-driven healthcare experience.

XIV CONCLUSION

The digital healthcare management system enhances patient–doctor communication and streamlines clinical workflows by allowing patients to easily book appointments, make payments, receive confirmations, upload reports, and join virtual consultations. Doctors can efficiently manage appointments, generate prescriptions, review patient data, and conduct telemedicine sessions, while administrators gain complete operational visibility through real-time dashboards and monitoring tools. Automated alerts and email confirmations improve transparency, reliability, and user trust. Scalable, secure, and user- friendly, the system meets all project objectives and provides a strong, future-ready foundation for a comprehensive, technology- driven healthcare solution.

XV ACKNOWLEDGMENT

We would like to express our sincere gratitude to K. Ramakrishnan College of Engineering, Samayapuram, Tiruchirappalli, for providing us with the opportunity, infrastructure, and academic support to carry out this research work on "A SMART AND EFFICIENT ONLINE DOCTOR APPOINTMENT BOOKING SYSTEM FOR STREAMLINED HEALTHCARE ACCESS". The
institution's supportive environment and access to essential resources played a significant role in enabling us to successfully complete this study. We extend our heartfelt thanks to our faculty members and mentors for their continuous guidance, valuable suggestions, and constructive feedback throughout the development of this project. Their expertise, encouragement, and timely support greatly helped us refine our approach and improve the quality of our research work.

We are also thankful to our department for creating a motivating academic atmosphere that encouraged us to explore emerging technologies in artificial intelligence and multimedia analysis. Our sincere appreciation goes to the management and administrative staff for their cooperation during the course of this work. We also acknowledge the support of our peers and classmates for their insightful discussions and collaborative spirit. Finally, we express our deep gratitude to our friends and family members for their constant encouragement, patience, and motivation, which helped us successfully complete and present this research.

XVI REFERENCE

[1] Kosalairaman, T., Maalini, D., Kiruthika, R., Janani, S. K., Nithya, T., & Pavithra, P. (2025, April). Smart Health Consulting and Appointment Booking System with Real- Time Scheduling and Patient-Doctor Communication. In 2025 3rd International Conference on Artificial Intelligence and Machine Learning Applications Theme: Healthcare and Internet of Things (AIMLA) (pp. 1-6). IEEE.

[2] Reddy, K. V., Saketh, G., Priyanshu, S. S., Nitesh, M., Hussain, S. K., & Sharma, K. V. (2025). AI-Driven Healthcare Management Platform: Enhancing Accessibility, Efficiency, and Security in Digital Health Systems. Synthesis: A Multidisciplinary Research Journal, 3(1), 1-14.

[3] Kothiya, B. (2025). Market analysis of an appointment booking system: understanding market demand and innovation in appointment scheduling systems.

[4] Siddiqui, C. B. Y., Supto, M. A. A., Jit, T. H., Sultana, A., Rahman, F., & Shidujaman, M. (2025, March). Connecting Patients with Healthcare. In Proceedings of the Second International Conference on Artificial Intelligence and Communication Technologies (ICAICT 2024): Smart Wireless Communications—Methods and Algorithms, Volume 1 (Vol. 424, p. 353). Springer Nature.

[5] Akhil, A. V., & Abraham, J. T. (2025). HOSPITAL BOOKING APP: A PROJECT WORK.

[6] Kumar, B., IQBAL, M., Parmer, R., Garg, P., Rani, S., & Agrawal, A. (2025, March). The Role of AI in Optimizing Healthcare Appointment Scheduling. In 2025 3rd International Conference on Disruptive Technologies (ICDT) (pp. 881-887). IEEE.

[7] Krishna, M. A. V., Pavan, G., Srikanth, B., Nagaraj, E., & Akshay, M. Integrated Patient Appointment Scheduling and Management System.

[8] Thakre, D. J., Bisane, V. D., Kumbhare, B., & Kanekar, Y. Encrypted Cloud-Based Health Appointment System Using AI.

[9] Safdar, S., Sirshar, M., Matloob, I., Ameer, E., Talib, M., & Zahid, Z. (2025). A Doctor's Appointment Scheduling System Using ML To Solve Long Patient Queues In Pakistani Govt Hospitals. International Journal of Information Systems and Computer Technologies, 4(2), 14-26.

[10] Panahi, O. (2025). AI in Healthcare Administration: Streamlining Processes for a More Efficient FuturE.