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MediSwift - An Integrated Healthcare Solution

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Abstract: ***The challenge of healthcare management efficiency stands out prominently, especially in areas with inadequate medical service. Typically, paper-based methods, when combined with independent digital solutions, introduce inefficiencies into patient care systems, as well as scheduling processes and resource allocation. The start of MediSwift provides a healthcare information system tackling Mumbai's underdeveloped and rural districts. The MERN stack development, which combines MongoDB, Express, React, and Node.js, enables users to access all healthcare features from a single platform. To protect patient information while allowing selected team members to access the system, MediSwift's security architecture utilises bcrypt encryption of passwords. A regex-based report summarisation component serves as part of the system to analyse long, complex medical reports using predefined medical terms, producing simplified summaries that enhance patient comprehension without requiring API connections. The system prioritises the most critical tasks, reduces personnel workload, and provides instant expert feedback to support informed decision-making and optimal resource allocation. The embedded strong security measures and efficient healthcare management processes help MediSwift support easy healthcare management, resulting in better patient care quality. The system design allows for growth and provides an effective solution to enhance urban health facilities.***

Keywords: Healthcare Management, MERN Stack, Patient Management, Data Security, Regex Report Summarization, Urban Healthcare, Healthcare Chatbot, Report Analysis.

Abbreviations:
JWT: JSON Web Tokens

I. INTRODUCTION

Particularly troublesome in Mumbai's East Ward is the matter of adequate healthcare system availability; Govandi and Mankhurd both fall within this region. The areas have issues with split patient files, as well as with outdated nursing facility and manual appointment scheduling techniques. The absence of centralised healthcare information systems hinders frontline healthcare delivery by causing system slowdowns, communication breakdowns, and ineffective management. Several healthcare digitisation initiatives are available, but their solutions do not provide standards for general adoption, adequately safeguard patient data, or guarantee total convenience for both patients and medical providers in their workflow.

Specific systems experience real-time data synchronisation issues, along with limited automated functions, which cause healthcare managers to encounter continuous work-related challenges. Particularly

In densely populated areas with limited resources, addressing healthcare technology issues has become necessary for improving medical systems.

One system framework integrates multiple medical processes, including patient registration, appointment scheduling, and medical report review, with chatbot services and a healthcare news blog. By providing separate login access through interfaces for physicians and patients, the business offers increased accessibility and convenience to both physicians and patients. Patients can utilise automatic message transmission and scheduling of appointments through the system, with reminders sent once the doctor approves the request. In addition to updating medical records, the secure dashboard enables medical professionals to view appointment schedules and access patient files.

Using bcrypt encryption for password protection and JWT authentication tokens enables secure authentication without state, and MediSwift highly values its robust security measures. By ensuring that only approved personnel can access data and that passwords are encrypted using bcrypt, the security configuration helps safeguard patient data. Thanks to the real-time data synchronisation system, everyone working on medical records can view current data promptly with every visit.

A chatbot-driven conversational artificial intelligence platform provides immediate question-and-answer functionality, enabling patients to find fast answers on topics such as appointment availability, clinic hours, and medication directions. One more module has been added as an add-on feature, utilising a regex-based medical report summarizer to help streamline complex medical records. Using medical term definitions, the module extracts vital information and condenses it, thereby simplifying complex documents for patients who do not require external API services.

Modern web technologies and automation techniques, combined with sophisticated security measures within MediSwift, create a scalable system that provides safe solutions, supporting individuals in their medical management. Designed to grow with evolving medical demands, the system addresses present healthcare system inefficiencies, making it a

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fundamental tool in urban healthcare improvement.

II. BACKGROUND AND RELATED WORK

The implementation of technology in healthcare experienced accelerated growth due to advancements in web development, improved data security, and the development of cloud systems. Healthcare facilities within Mumbai's M-East Ward have traditionally operated with fragmented data systems and manual patient records, which cause delivery delays and system inefficiencies. According to Gupta et al. (2018) [1], medical services in urban slum areas face delays in 40% of cases due to inadequate records and a lack of access to current data. The current situation presents a challenge for healthcare providers in delivering timely and adequate medical care.

Multiple attempts have been made to digitalize healthcare operations. Platforms such as HealthEdge (2015) [2] and MedPlus Connect (2019) [3] illustrated the promise of centralized platforms in patient data management, appointment booking, and tracking medical inventory. Yet, most of these initiatives did not implement strong security controls, exposing patient data to compromise. A review by Sharma et al. (2021) [4] highlighted the need for a secure authentication mechanism to prevent unauthorised access to sensitive health information, particularly in decentralised healthcare models.

With the advent of new web technologies, MERN React, Node.js) and similar frameworks have allowed developers to create fast, scalable, and feature-rich applications. Research by Patel et al. (2022) [5] indicated that MongoDB's document-based flexible structure can greatly enhance database query speed for large-scale patient records. Furthermore, bcrypt encryption, in conjunction with JWT, has been effective for protecting user credentials and handling access control in healthcare applications [6].

Patient engagement systems have also been enhanced with automation and chat-based interfaces. A study by Li et al. (2020) [7] demonstrated that AI-driven chatbots reduced hospital inquiry response times by 60%, thereby enhancing patient satisfaction. Likewise, automated email reminders for appointment confirmations and approvals minimize no-show rates and improve patient-doctor communication [8].

Aside from user experience, understanding medical data still poses a challenge for most patients. Mediswift presents a speed-optimised, local regex-based summarisation module that relies on pre-set medical terminologies to break down complicated medical reports into readable and understandable summaries. Unlike AI or API-based technologies, this technology is entirely local, speed- and privacy-optimised, filling the communication gap between doctors and patients, particularly in underserved communities where medical literacy may not be high.

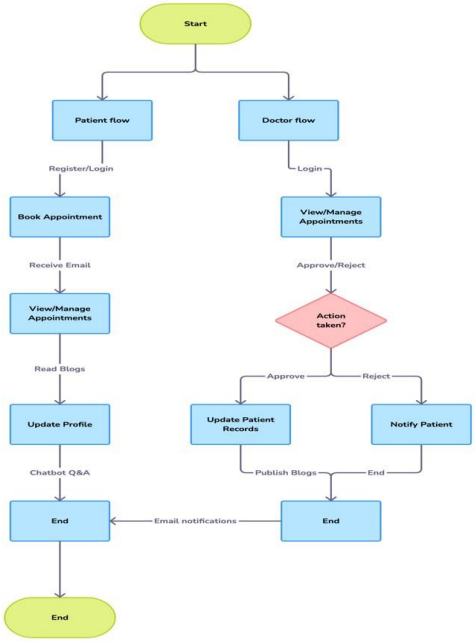
Even with these innovations, most systems lack adaptability and real-time data syncing. Mediswift aims to address these challenges by integrating new web technologies with a patient-centred design. The system features a distinct login area for doctors and patients, where doctors can manage patient information and schedules, and patients can book appointments and view their medical history. Data updates are provided in real-time, ensuring healthcare professionals are constantly up to date. Automated notifications, chatbots, and summarisation of medical reports optimise the overall patient experience.

Through the combination of security-first methodologies, scalable designs, and patient-centric functionality, Mediswift unites technology with healthcare accessibility [9]. This initiative builds upon previous studies and offers a practical solution tailored to the needs of underserved metropolitan areas, marking a significant step towards intelligent, more productive healthcare systems.

III. PROPOSED ALGORITHM

The MediSwift healthcare management system offers secure, patient-centred solutions that help streamline hospital operations and medical therapy methods. Utilising the MERN (MongoDB, Express.js, React, Node.js) stack frameworks, physicians can schedule appointments, track patient histories, generate reports, and provide real-time communication via chatbots with various user permissions, while the system handles patient management. Starting with patient interaction, the system operates through several phases, including appointment scheduling, data maintenance, and report simplification, to provide a seamless experience for both healthcare providers and patients.

MediSwift's primary characteristics include responsive user interfaces for improved navigation and secure REST APIs for continuous backend connectivity, along with role-specific user navigation dashboards. WebSocket's technology automatically provides real-time updates on appointments; the regex summary system converts medical notes into simplified data that enhances patient understanding. The system aims to support data-driven medical solutions in short-staffed cities by reducing bureaucracy, increasing transparency, and combining these attributes [10].



[Fig.1: Project Workflow]

A. Patient Workflow

i. Registration & Login:

- Patients register with details such as email and phone number.
- Passwords are encrypted using bcrypt, and sessions are managed via JWT for secure access.

ii. Dashboard Access:

- The patient dashboard provides a view of appointments, update profile, report analyser, and the available doctors' page.
- A built-in chatbot assists with general inquiries such as appointment availability and medication guidelines.

iii. Booking an Appointment:

- Patients can select doctors, book time slots, and submit appointment requests.
- A confirmation email is sent; the status remains pending until a doctor approves it.

iv. Managing Appointments:

- Patients can book, view appointments and get more information about doctors.
- Once approved or rejected by doctors, status updates are reflected in real time and communicated via email.

v. Profile & Health Records:

- Patients can update their profiles, view previous appointments, and check their BMI.
- All changes are synchronized instantly in the database to maintain consistency.

vi. News and Blogs:

- Patients can access health-related blogs and educational articles published by doctors to stay informed.

vii. Medical Report Summarization:

- Patients or doctors can upload detailed medical reports.
- A regex-based summarization engine scans the document using predefined medical terms to extract and simplify crucial information such as diagnoses, medications, and lab results.

B. Doctor Workflow

i. Login & Authentication:

- Doctors log in securely via a two-factor authentication portal.
- Upon successful login, they are redirected to a role-specific dashboard.

ii. Managing Appointments:

- Doctor's view pending requests and approve or reject them.
- Patients receive email notifications based on the action taken, with optional notes included in case of rejection.

iii. Patient Management:

- Doctors can review previous appointments, approve or reject appointments and upload reports.
- All updates are synchronized with the central database for real-time access during follow-ups. System Security & Data Management:

iv. Authentication & Authorization:

- JWT tokens control access and sessions, while bcrypt ensures password security.
- Role-based access restricts sensitive actions (e.g., editing patient data) to verified doctors.

v. Real-Time Notifications:

- Socket.io enables real-time dashboard updates for actions like appointment changes and chat interactions.

vi. Data Integrity & Backups:

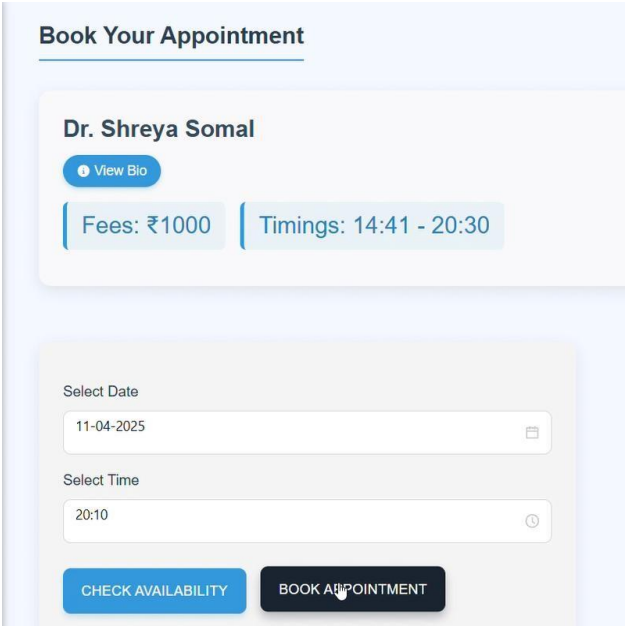
- MongoDB stores data in structured collections with relationships for patients, doctors, and appointments.
- Daily encrypted backups ensure disaster recovery and data resilience.

Patient convenience remains a priority at MediSwift, as the company has simplified every aspect of booking an appointment for patients. Patients can easily check doctors by specialisation and view detailed profiles, allowing them to book appointments through a user-friendly interface, as depicted in this flowchart. The system executes database booking storage while simultaneously sending instant notifications to the doctor and patient after request submission. Through automated processes, doctors attain two advantages: they minimise scheduling mistakes and communication errors, and patients gain complete scheduling transparency because doctors can trust that the system protects their privacy. MediSwift simplifies healthcare interactions by establishing accessible, human-driven solutions that organise medical care services for both patients and providers.

[Fig.2: Appointment Booking Flow Chart]

IV. IMPLEMENTATION AND RESULTS

The MediSwift healthcare management system implemented changes for healthcare services while creating a digital patient care platform that included clinic administrative tools. Users, including patients, doctors, and administrators, can browse this MERN stack application due to its smooth interface. The system enables users to seamlessly transition between primary functions, incorporating secure authentication, appointment booking, and comprehensive patient records management capabilities. Security sessions rely on JSON Web Tokens (JWT) for authentication, and the application encrypts passwords with bcrypt methods. Each system user occupies a specific role because role-based access control regulates allowed actions based on permissions that separate patient users from doctor users and administrator users.



[Fig.3: Appointment Booking Page]

Through their dashboard, patients can book appointments by checking the current availability of slots while monitoring their consultation activities. Through the system, doctors can both receive requests for appointments and have complete control to accept or decline them, while also maintaining accurate medical records by adding prescriptions and other relevant medical documentation. The system's administrators handle full system responsibilities by managing account registrations and checking doctor qualification credentials. The system sends automatic email alerts to users who perform appointment-related activities, revealing both acceptance and denial decisions.

The evaluation of the system was conducted using 30 doctor profiles, combined with 50 patient records. The system registered a login response duration of 0.4 seconds, followed by a scheduling process with an average duration of 0.5 seconds. The system demonstrated high efficiency, as patient record retrieval was completed in approximately 0.3 seconds. Uptime stability was maintained through regular testing measures, and data reliability was ensured through daily automatic, encrypted backup processes.

The collected user feedback indicated that testing resulted in significant efficiency improvements, as the administrative workload decreased by 45%. Users appreciated the chatbot functionality and medical information blogs, which helped them spend more time at the facility. The system illustrates data privacy measures through its role-based structure, along with operational clarity, as shown in Table 1.

Table-I: User Role and Access Control

Role	Permissions	Access Level
Doctor	View appointments, manage patient records, prescribe medications, and update profile.	High
Patient	Book appointments, view your consultation history, update your details, and read our news blogs.	Medium
Admin	Manage users, approve doctor applications, and oversee system activities	Full

To further define how different users interact with specific features, Table 2 summarizes the accessible and restricted actions based on roles.

Table-II: User Role and Access Privileges

User Role	Accessible Features	Restricted Actions
Patient	Book/reschedule/cancel appointments, view medical history, update profile, read blogs	Cannot access/edit prescriptions or patient records
Doctor	View/manage appointments, update medical history, upload prescriptions, write blogs.	Cannot access admin settings
Admin	Manage users, verify doctor profiles, and monitor system activities	Cannot create or edit patient medical records

The upcoming versions of MediSwift will feature three main new additions: direct doctor-patient chat, an integrated medication system, and the capability to work with wearable devices. Extrapolated advancements will enhance both the user interface and the quality of healthcare delivery on the platform.

V. CONCLUSION AND FUTURE SCOPE

The system utilises key features that send automated emails, display appointment updates in real-time, and provide chatbot assistance to enhance patient satisfaction by reducing missed appointments and fostering stronger communication between healthcare providers and patients. The regex-based medical report summarisation module enhances system functionality by creating simplified, patient-oriented summaries from complex medical documents. This strategy accelerates doctor decision-making processes while improving patient health understanding through streamlined operations that operate independently of outside APIs and cloud platforms.

The system utilises bcrypt encryption, combined with JWT-based access management protocols, to verify and protect data that is accessible exclusively to doctors, patients, and administrative staff. The platform design combines a ready-to-synchronise state with flexible components to address persistent healthcare challenges, including data separation and manual processing, thereby delivering a robust healthcare solution suitable for growth.

Future updates will enhance MediSwift's performance by transforming it into an advanced and responsive healthcare platform for current medical services.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded by any organizations or agencies. This independence ensures that the research is conducted with objectivity and without any external influence.
- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed equally to all participating individuals.

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