IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 7, April 2025
Impact Factor: 7.67

ROGISETU: A Web-Based OPD and Token Management System for Public Hospitals

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Abstract: *The increasing patient load and manual outpatient registration processes in urban public hospitals often result in long queues, inefficient administration, and poor patient experiences. To address these issues this paper proposes ROGISETU—a web-based hospital OPD management system to streamline appointment booking, real time token tracking and hybrid queue management for both online and offline patients. ROGISETU allows patients to register from home or from hospital and get automated token numbers with live status updates through SMS or web portals. Built using modern technologies like React.js, Supabase, PostgreSQL and Tailwind CSS the system ensures scalability, security and real time performance. The platform has role-based dashboards for patients, department admins and hospital admins to manage queue, tokens and inventory. With real time updates and digital verification mechanisms the system reduces reception congestion and enhances overall OPD experience. The proposed solution lays the foundation for future enhancements like ABHA integration, multilingual support, pharmacy inventory modules and doctor scheduling. ROGISETU is designed to be a scalable and modular framework as per India's vision of digitally transforming public healthcare infrastructure*

Keywords: OPD Management System, Token Queue Management, Real-Time Tracking, Public Healthcare, Web Application, Appointment Scheduling

I. INTRODUCTION

The healthcare sector, particularly in developing nations like India, faces critical challenges in delivering timely and efficient services to patients, especially in government hospitals that cater to a large volume of the population. Among the most burdened areas of hospital services is the Outpatient Department (OPD)(Junagade et al., n.d.-a), where thousands of patients visit daily for consultations, follow-ups, and primary care. The traditional process of manual registration, token allocation, and physical queue handling often results in long waiting times, overcrowded reception areas, and administrative delays(Pariyar et al., n.d.). These inefficiencies not only lead to patient dissatisfaction but also significantly hinder the workflow of healthcare providers.

In an age where digitization is transforming nearly every sector, healthcare too must evolve from paper-based systems to smart, technology-driven platforms that improve patient management and service delivery(Yelne et al., n.d.). Several private healthcare platforms offer appointment booking and telemedicine features, but most are either commercially focused or not integrated with public healthcare ecosystems(Behl et al., 2024b). Moreover, systems like ORS (Online Registration System) are limited in scalability and functionality when it comes to real-time queue management, offline patient integration, or role-based administrative control(Garware et al., 2022).

To overcome these challenges, this paper introduces ROGISETU — a web-based OPD and token management system developed specifically for public hospitals. ROGISETU aims to simplify the entire outpatient workflow by offering a hybrid registration model (online and walk-in), automated token generation, and real-time queue tracking through a user-friendly interface(Rylan et al., n.d.). Patients can register from home or at the hospital, receive digital tokens, and get SMS notifications for their appointment status and token number. Hospital staff, on the other hand, can monitor queues, validate patient entries, and manage departments through role-specific dashboards(Lakshmi et al., n.d.).

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Technically, ROGISETU is built using modern web technologies including React.js for the frontend, Tailwind CSS for responsive styling(Junagade et al., n.d.-b), Supabase as the backend platform (providing real-time database operations, authentication, and APIs), and PostgreSQL as the core database. The platform is designed to be scalable, modular, and future-ready, allowing for the integration of features like pharmacy inventory management, bed availability, doctor scheduling, and ABHA (Ayushman Bharat Health Account) integration in future versions(Balamurugan et al., n.d.).

ROGISETU not only addresses immediate operational challenges in public OPDs but also contributes toward India's broader mission of creating a digital, accessible, and transparent healthcare infrastructure. Through automation and real-time data processing(Barbàra et al., 2023), the system enhances patient experience, optimizes hospital resources, and sets a foundation for broader healthcare digitization in government institutions(Behl et al., 2024c).

The study leads to the following Research Objectives (ROs):

RO1: How can a web-based system improve the efficiency and transparency of OPD appointment booking and queue management in public hospitals?

RO2: What role can real-time token generation and hybrid (online/offline) patient registration play in reducing congestion and manual workload at hospital reception counters?

RO3: What are the technical and architectural advantages of using Supabase, PostgreSQL, and React.js in building a scalable hospital OPD management system like ROGISETU?

II. LITERATURE REVIEW

2.1 Literature Review of Existing System

Several research efforts and system prototypes have been proposed in recent years to address inefficiencies in hospital OPD workflows and appointment systems. These works provide useful insights into the use of technology for streamlining outpatient management, although most are limited in terms of scalability, real-time features, or public healthcare integration.

(Rathod et al., 2022) proposed an online OPD and hospital information system based on the MERN stack that enables doctor appointment booking, online consultation, and patient history management. However, the system was primarily designed for single-hospital environments and lacked scalability for multi-hospital networks or integration with government health databases.

(Garware et al., 2022) introduced an OPD management system with a rating and review mechanism for healthcare providers, supporting real-time consultation updates and patient history. Despite its user-oriented features, the system faced challenges with data privacy, internet dependency, and integration across diverse hospital infrastructures.

(Yelne et al., n.d.) developed a digital healthcare system for smart IPD booking, focusing on mobile accessibility, ambulance scheduling, and facility tracking. The system was promising but limited by ERP integration difficulties and real-time operational scalability.

(Junagade et al., n.d.-b) presented a mobile-based OPD appointment system allowing registration, appointment booking, and access to patient reports. While the platform supported essential services, it lacked deep integration across multiple hospitals and advanced security features.

(Rylan et al., n.d.) and colleagues built an online scheduling system with payment integration for patients and doctors but were unable to deploy it in a real hospital setting due to pandemic restrictions.

(Pariyar et al., n.d.) created a mobile-based doctor appointment booking application that featured queue tracking, emergency support, and geo-mapping. However, the system's dependency on consistent internet connectivity and the need for hospital-wide onboarding were significant limitations.

Finally, S.S.D.K. Maha Lakshmi et al. implemented an outpatient queue system that focused on token generation and reduced waiting times. However, the system relied heavily on manual input and was susceptible to errors in real-time operational environments.

These studies highlight the growing interest in digitizing OPD workflows but reveal gaps such as lack of real-time features, role-based access, and hybrid appointment handling. ROGISETU builds upon these works by offering a comprehensive, real-time, and scalable platform that supports online/offline registration, automated token generation, SMS alerts, and role-based dashboards—all while being designed with public hospital infrastructure in mind.

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2.2 Research Gaps

Despite multiple efforts toward digitizing hospital OPD systems(Akmal Jahan et al., 2021), existing solutions reveal several functional and structural limitations, particularly when applied to large-scale public healthcare settings(Kopetz et al., n.d.). After reviewing current literature and related systems, the following research gaps have been identified:

Lack of Real-Time Queue and Token Management: Most existing systems do not offer live tracking of OPD queues or dynamic token updates(Rajkumar, 2012), leaving patients unaware of their position and increasing waiting room congestion.

No Unified Support for Online and Walk-In Appointments: Several platforms are limited to either online or offline appointment handling(Ko et al., n.d.), lacking a hybrid model that accommodates both seamlessly within the same queue management system.

Limited Role-Based Access and Admin Control: Current systems often fail to provide dedicated dashboards and permission-based functionalities for different user roles such as patients, department admins, and hospital admins(Kavitha et al., n.d.).

Insufficient Adaptability to Public Healthcare Infrastructure: Many proposed solutions are built for private setups and do not align with the operational constraints, workflows, or data requirements of government and municipal hospitals.

Lack of Scalability and Future-Ready Design: Most reviewed systems are not cloud-based and do not support future expansions such as multilingual support, pharmacy inventory management, doctor scheduling, or ABHA integration.

2.3 Existing System Study and Comparative Analysis

To understand the current landscape of digital OPD management solutions, a comparison of widely used platforms such as ORS.gov.in, mCURA, and Practo was conducted. Each of these systems offers unique functionalities in the context of patient registration, appointment handling, and data access. However, they fall short in key areas such as real-time queue management, hybrid appointment handling, and integration with public healthcare infrastructure(Behl et al., 2024a). The following table outlines a feature-wise comparison of these existing systems with the proposed ROGISETU solution:

Platform	Key Features	Limitations
ORS.gov.in	- OPD appointment booking for public hospitals - ABHA integration - Access to lab reports - SMS notifications	- Limited to public hospitals - No real-time queue tracking - Lacks predictive analytics
mCURA	- Digital token and queue system - Patient record management - Diagnostic report integration - Supports online and walk-in bookings	- No AI or predictive analytics - Limited inventory management - Minimal real-time communication
Practo	- Online doctor appointments - Teleconsultation - Health record storage - Doctor reviews and ratings	- Focused on private healthcare - No ABHA or public system integration - Limited OPD management
ROGISETU (Proposed)	- Automated queue management - Real-time token updates - Supports both online and walk-in appointments - Cloud-based (Supabase) - Predictive insights from patient data - Patient notifications & improved engagement	- Future enhancements under development: ABHA integration, bed tracking, pharmacy inventory, multilingual support

Table 2.3.1 Existing System Study and Comparison Analysis

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From the above Table 2.3.1, it is evident that while existing systems provide fragmented solutions, none offer a unified platform that supports both online and offline appointments, real-time queue updates, and role-based access across hospital roles. ROGISETU addresses these gaps by combining the strengths of these systems and extending them with cloud-based storage(Bajpai & Wadhwa, 2021), automated token control, and patient notification features. Furthermore, its modular architecture ensures that future integration with features such as ABHA, bed tracking, and pharmacy inventory is achievable without major redesign.

2.4 Summary and Research Direction

Review of existing systems and literature shows that there is a need for a comprehensive and scalable solution to manage outpatient department (OPD) workflows in public healthcare settings. While many systems provide basic features like appointment booking and patient registration(Goyal et al., 2020), they often lack real-time queue management, hybrid appointment handling and role-based access control. Most of the existing solutions are designed for private healthcare and do not address the operational challenges of government hospitals.

This gap in functionality and adaptability points towards a system that is not only technically robust but also aligned with public healthcare infrastructure(Practice & 2016, n.d.). ROGISETU addresses these challenges by providing a real-time, cloud ready platform that supports online and offline appointments, automated token generation and role-based dashboards for seamless hospital administration(Daimi et al., 2018).

The research direction is to develop and enhance digital health solutions like ROGISETU that can integrate with government healthcare ecosystem. Future research may explore modules for multilingual support, pharmacy inventory tracking, doctor scheduling and integration with national health identifiers like ABHA(Nanawati et al., n.d.). The ultimate goal is to build a platform that not only improves operational efficiency but also patient experience in public hospitals.

III. SYSTEM IMPLEMENTATION

The implementation of the ROGISETU platform was designed to be modular, scalable, and user-centric, ensuring seamless operation across multiple hospital roles and departments. The system architecture integrates modern web technologies with real-time database operations and role-based dashboards to address the inefficiencies in traditional OPD workflows.

3.1 System Architecture Overview

The architecture of ROGISETU follows a multi-tier, role-based model, where each user (patient, department admin, hospital admin, super admin) interacts with the system through a defined interface.The architecture of the *ROGISETU* system is designed to streamline outpatient department (OPD) processes for both online and offline users, enabling token generation, queue management, real-time updates, and notifications. The system is based on a modular structure and leverages modern web technologies with a Supabase backend for secure, scalable data handling.

1. Online User Module

Online users access the system via Web or Mobile App. User fills OPD registration form with details. Upon submitting the form, a request is sent to backend to generate OPD token. Backend processes the request and generates a digital token. SMS is sent to user's mobile with confirmation and token details. System ensures real-time updates on queue position and estimated wait time.

2. Offline User Module

Offline users physically come to hospital and wait in manual queue. Central Admin at reception registers these users and enters their details in the system. Admin communicates with backend to request token generation. Based on current load and queue status, system estimates wait time for offline users. Both offline and online queues are managed together for fair allocation.

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3. Token Generation Module (Backend)

Backend is the core processing unit that handles OPD form requests, token generation and queue balancing. It maintains synchronization between online and offline users, updates queue position dynamically. Backend also interacts with Supabase Database to store patient details and status.

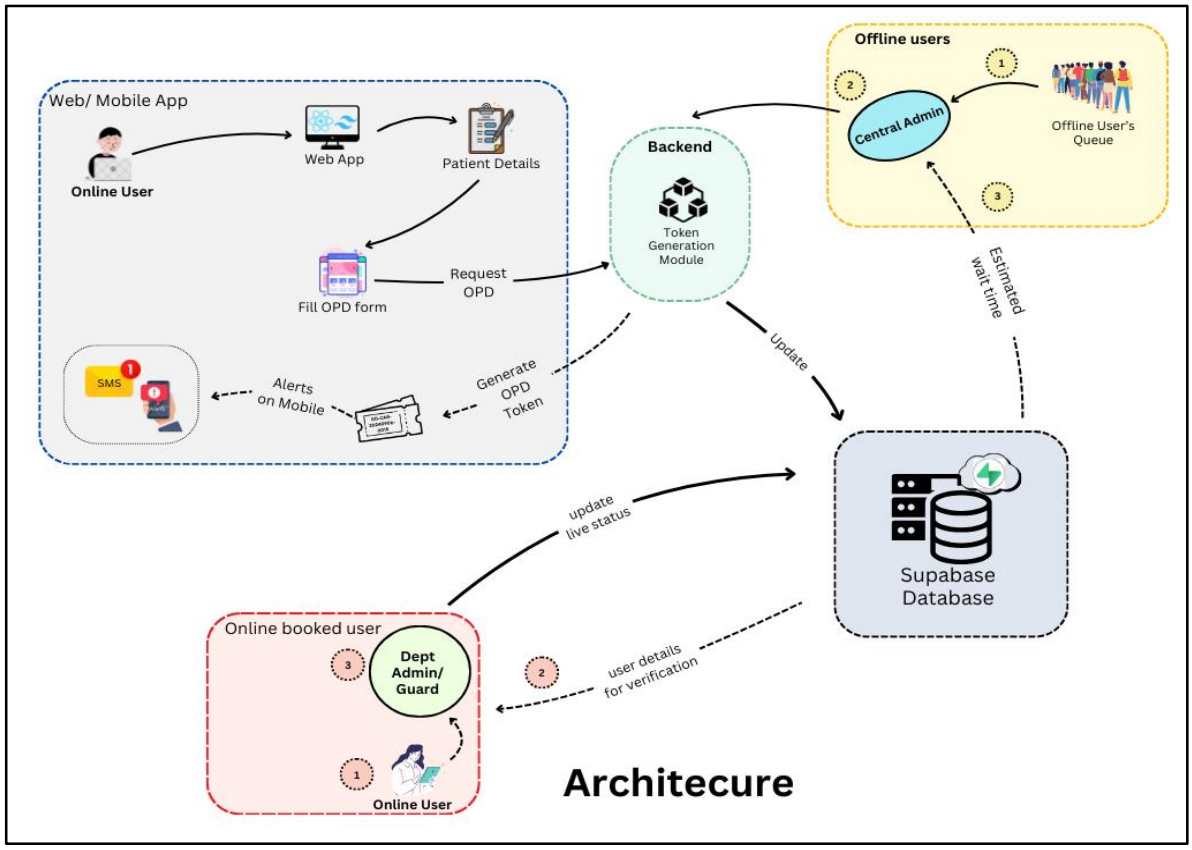

Fig 3.1.1: System Architecture Diagram.

4. Supabase Database

Acts as central repository for all patient, token and queue related data. Supports real-time updates, enables live queue status and notifications. Stores user credentials, OPD bookings and verification details.

5. Online Verification Module (Department Admin / Guard)

When online booked users come to hospital, their details are verified by Department Admin or Guard. Once verified, user is marked as present and their live queue status is updated in the system via Supabase. This ensures smooth transition from virtual booking to physical presence.

Key Features in the Diagram:

- Dual access for Online and Offline users.
- Centralized backend token management.
- Supabase for authentication, real-time syncing and secure storage.
- SMS based notifications and alerts for online users.
- Integrated verification at hospital end for seamless check-in.
- This architecture ensures transparency, improves hospital operational efficiency and reduces waiting time by automating and digitizing OPD queue system.

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3.2 System Implementation

The database design of the ROGISETU system follows a normalized relational model using **Supabase** (PostgreSQL) to ensure efficient data storage, security, and real-time access. The schema is designed to handle multi-role access, hospital-level configuration, OPD scheduling, and real-time token tracking. The following are the key entities and their relationships:

- **Patients Table:** Stores personal data of registered users including name, age, gender, and contact details. Linked to auth.users for secure authentication.
- **Admins Table:** Contains information about all administrative users such as department and hospital admins. Includes role, hospital_id, and department_id for assigning control scopes.
- **Hospitals Table:** Stores static information of each hospital including name, location, contact_number, and email.
- **Department_Types and Hospital_Departments:** These two tables define department categories and assign them to specific hospitals. Fields such as daily_token_limit and status help manage department availability and OPD capacity.
- **Department_Time_Slots:** Manages the operating hours and token scheduling per department, with fields like start_time, end_time, slot_duration, and lunch breaks.
- **Appointments Table:** A core component that logs all OPD appointment details, including token_number, time_slot, status, and date. It maintains foreign key relationships with patients, hospitals, and departments.
- **Push_Subscriptions Table:** Used to store web push notification endpoints for users, enabling real-time alerts about token updates and OPD reminders.

Data Relationships:

Each appointment is linked to a patient, hospital, and department, reflecting real OPD workflows.
Admins are mapped to specific departments or hospitals, enforcing role-based access.
Departments are assigned modularly using type mappings for flexibility.
Time slots are individually managed to accommodate hospital schedules.
Subscriptions enable patient-specific notifications, improving engagement.
This schema ensures scalability, data consistency, and modular expansion for future components like pharmacy inventory, bed tracking, and multilingual support. Supabase's real-time features allow for instant updates to token queues and appointment records, enhancing user experience and administrative efficiency.

3.3 System Architecture and Role-Based Design

The architecture of ROGISETU follows a modular, multi-tier, role-based design that supports secure, scalable, and maintainable interactions between various stakeholders within a hospital environment. The system is designed to meet the functional demands of outpatient management while ensuring real-time performance and user accessibility.

1. Layered Architecture Overview

The architecture is structured into the following primary layers:
Frontend (Client Layer):Developed using React.js and styled with Tailwind CSS and Shadcn UI, the frontend provides user interfaces for all roles, including patients and hospital staff. The application communicates with the backend through REST APIs and Supabase SDKs, ensuring fast and secure data transactions. Key frontend functionalities include:
Patients: OPD booking, queue tracking, admission forms, bed and medicine availability.
Admins: Dashboard access to manage queues, appointments, departments, and inventory.
Backend (Application Layer):Powered by Supabase, the backend handles business logic for appointment scheduling, token generation, inventory management, and user authentication. Supabase provides built-in support for:
Role-based access control

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Real-time updates using subscriptions
Notification handling (SMS and push alerts)
Database (Data Layer):The system uses PostgreSQL, managed by Supabase, to store data such as patient records, appointment logs, hospital details, and user roles. The schema is fully normalized, with foreign key constraints and indexes ensuring consistency and performance. Supabase's real-time syncing enables live token and queue tracking across devices.

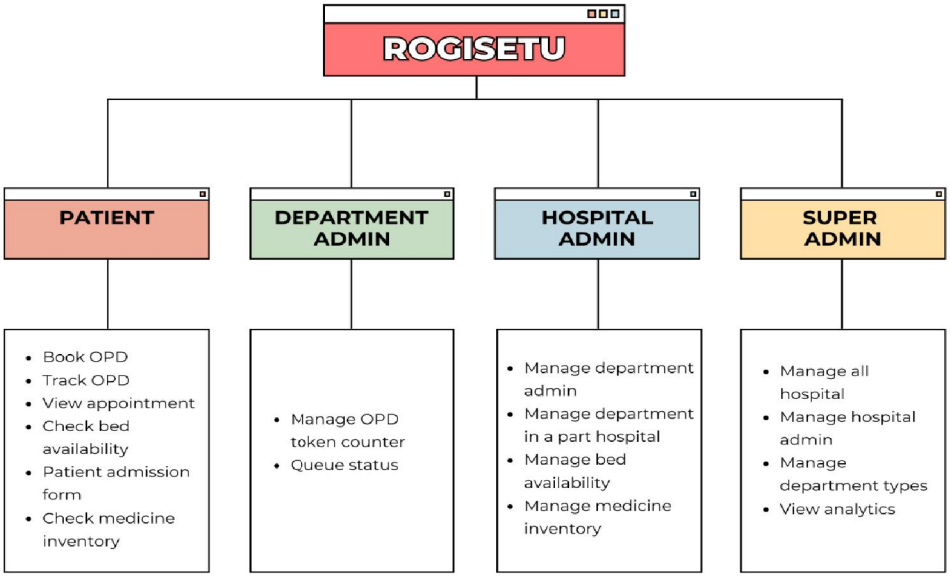

Fig. 4.3.1 Roles & Responsibilities

2. Notification System

ROGISETU incorporates a real-time notification module using push subscriptions to keep patients updated on:
OPD booking confirmations
Token number status and queue position
Appointment reminders
This enhances patient experience and minimizes missed appointments.

3. Security Design

Security is enforced using Supabase Auth, providing:
Email/password-based authentication
Role-based data access via row-level security (RLS) policies
Secure session management with token-based access control
This ensures that users only access data relevant to their role, enhancing data privacy and system integrity.

4. Scalability and Maintenance

The system is designed to be modular and cloud-ready:
New hospitals, departments, or user roles can be added without significant codebase changes.
Admin dashboards offer analytical views for decision-making.
The architecture supports seamless future expansion for features like doctor scheduling, pharmacy billing, and e-prescriptions.

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IV. RESULTS AND DISCUSSION

The ROGISETU platform was successfully developed and tested as a prototype solution to address core challenges in outpatient department (OPD) management within public healthcare institutions. The implementation focused on real-time token generation, hybrid patient registration (online and offline), queue monitoring, and role-based administrative control.

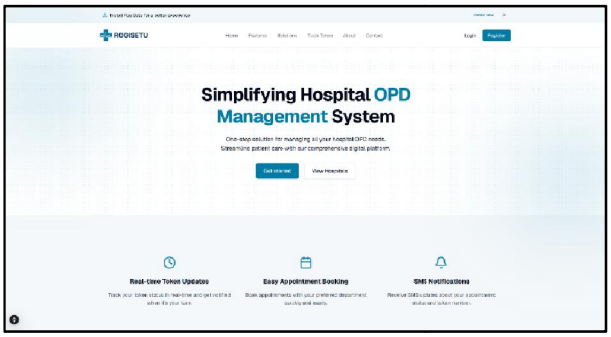

Fig.5.1.1 ROGISETU OPD System Home Page - Core Features Overview

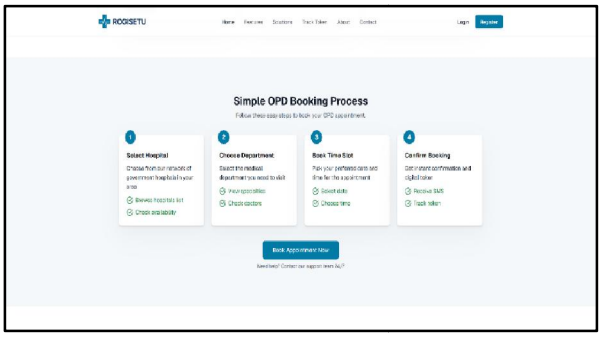

Fig.5.1.2 ROGISETU Booking Process Page - Four-Step OPD Appointment Workflow

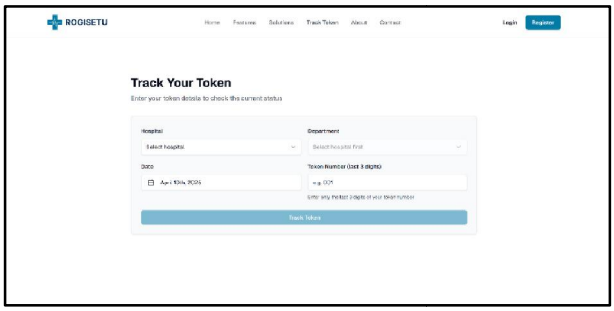

Fig.5.1.3 ROGISETU Token Tracking Page – Public Interface for Monitoring Appointment Status

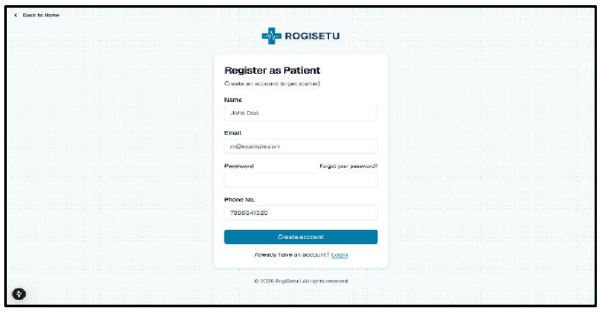

Fig.5.1.4 ROGISETU Patient Registration Page - Account Creation Form

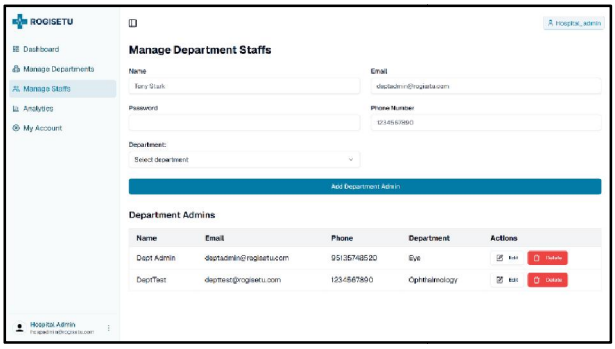

Fig.5.1.5 ROGISETU Patient Dashboard - Appointments View with Status Tracking

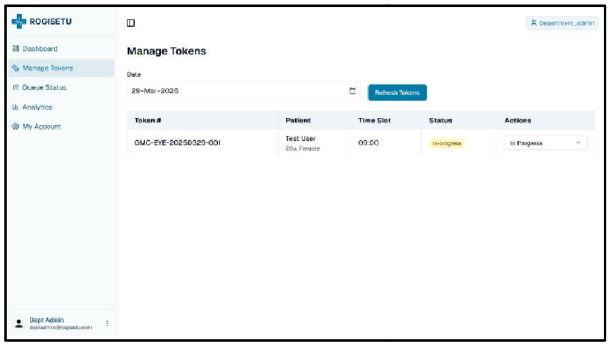

Fig.5.1.6 ROGISETU Department Admin Dashboard - Token Management Interface

DOI: 10.48175/IJARSCT-25451

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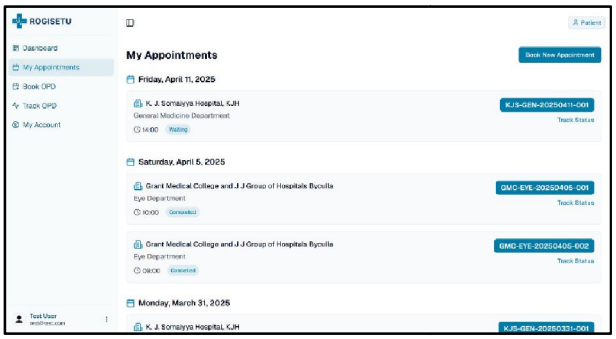

Fig.5.1.7 ROGISETU Hospital Admin Panel - Department Staff Management Interface

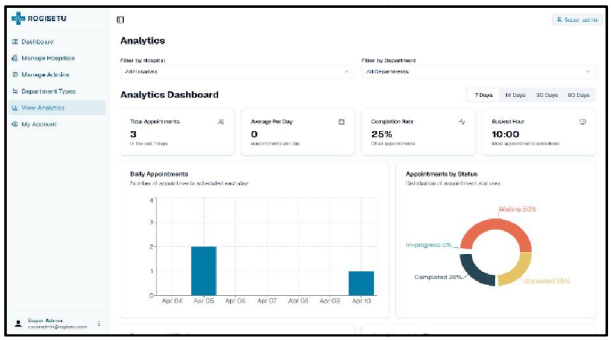

Fig.5.1.8 ROGISETU Analytics Dashboard for Super Admin - Performance Metrics and Appointment Statistics

V. CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

The ROGISETU project addresses key challenges in public healthcare systems, particularly the inefficiencies in OPD registration, manual queue handling, and overcrowded reception areas. By digitizing the appointment process and supporting both online and walk-in patient registrations, the system effectively reduces waiting times and enhances the flow of outpatient services. Key features such as virtual queue management, real-time status updates, automated OPD token generation, and patient notifications contribute to a more organized and patient-friendly experience. Built using modern technologies like React.js, Supabase, PostgreSQL, and Shadcn UI, the system ensures scalability, responsiveness, and future adaptability. Overall, ROGISETU contributes toward improving operational efficiency in hospitals and provides a foundation for delivering faster, smarter, and more convenient healthcare services to the public. It serves as a stepping stone toward the digital transformation of hospital workflows with the potential for broader adoption in urban healthcare networks.

5.2 Future Scope

The future scope of the ROGISETU system holds great potential for enhancing healthcare services even further, leveraging advancements in technology and expanding its features. Key areas of future development include:

1. Integration with ABHA (Ayushman Bharat Health Account):

In the future, the system can be integrated with the ABHA platform to enable secure and unified patient identification across government hospitals. This would help in maintaining digital health records and simplifying patient verification processes.

2. Real-Time Bed Availability Tracking:

A module can be added to monitor and display real-time bed availability across departments. This would assist in faster admissions and better hospital resource planning.

3. Pharmacy Inventory Management:

Integration of a pharmacy module would allow hospitals to manage medicine stocks efficiently, issue prescriptions digitally, and alert staff about low inventory levels.

4. Doctor Schedule and Availability Tracking:

The system can be extended to include dynamic doctor scheduling, allowing patients to view available time slots and book consultations accordingly.

6. Multilingual Support:

To improve accessibility, the application can support regional languages, allowing patients to use the platform in their preferred language.

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7. Advanced Inventory Management with Supplier Integration:
Real-time integration with pharmaceutical suppliers could be added to streamline the hospital's inventory management. The system could automatically place orders when stock runs low, ensuring a consistent supply of medicines and medical equipment, and reducing shortages.
8. Patient Feedback and Satisfaction Analytics:
The system could include features for collecting and analyzing patient feedback in real time, allowing hospitals to continuously monitor patient satisfaction and identify areas for improvement. Machine learning algorithms could analyze trends and generate reports for hospital management.

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IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 7, April 2025
Impact Factor: 7.67

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