

CareOrbit: Hospital Management Through Scheduling and AI-Based Chatbot for Patient Interaction

Supriya Chandra¹; Sonali Chandra²; Nijal Shah³;
Kashish Bhatt⁴; Dr. Saurabh Shah⁵

^{1,2,3,4} Department of Computer Science and Engineering,
Parul Institute of Engineering and Technology, Gujarat, India

⁵ (Professor and Director, Talent and Career Development)
Department of Computer Science and Engineering,
Parul Institute of Engineering and Technology, Gujarat, India

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Abstract: The rapid digital transformation of healthcare has given rise to the need for efficient hospital management systems that reduce paperwork, improve transparency, and enhance the patient experience. Paperless Out-Patient Department (OPD) systems eliminate reliance on manual records, streamline hospital workflows, and improve coordination. Inspired by platforms such as PrescoIPD [1], this paper reviews the motivation behind hospital digitalization systems, their literature foundations, methodology including technical frameworks, workflow analysis, and potential benefits.

Special focus is given to mobile-linked notifications that keep patients informed in real time regarding appointments, prescriptions. In addition, [2] the integration of a chatbot assistant provides instant guidance, recommends lifestyle changes and food intake according to chronic diseases and allergies, and improves patient interaction. The system also leverages communication services such as Twilio SMS for Notifications, ensuring seamless connectivity between hospitals and patients.

Keywords: Hospital Digitalization, Paperless OPD, Patient Notification, Healthcare Information Systems, Doctor Scheduling System, Chatbot Support.

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I. INTRODUCTION

Hospitals face increasing pressure to handle large volumes of patient data, medical records, and workflows. Traditional paper-based systems result in inefficiencies, errors, and lack of transparency. Patients often experience long waiting times, delayed updates, and difficulties in accessing past medical history.

Paperless OPD hospital management systems are a response to these challenges. By digitizing patient admission, treatment allocation, prescriptions, these systems ensure a streamlined workflow. Furthermore, mobile linked notifications strengthen patient engagement, ensuring they receive timely updates about their health care journey.

To further support patient interaction [2], a dedicated chat bot assistant is integrated into the system. The chat bot provides lifestyle and dietary recommendations for chronic conditions as asked, and is available 24/7 to answer common queries.

The system provides doctors with a digital scheduling module where they can mark their availability or absence and view their appointments through an intuitive calendar interface, helping to avoid scheduling conflicts. Administrators can access a consolidated view of all doctors' calendars to efficiently allocate resources and ensure smooth hospital operations. Additionally, the structured digital records enable doctors to instantly access patient history, prescriptions, and treatment details, supporting data-driven clinical decisions.

II. LITERATURE SURVEY

The digital transformation of healthcare has been a growing area of study, with a strong emphasis on hospital digitalization, paperless management systems, and patient-centered communication tools. In more recent studies, researchers have explored the role of hospital management systems (HMS) and paperless records in streamlining operations. [3]Smith et al. (2024) conducted a systematic review on the impact of digital hospitals, evaluating clinician and patient experiences in digitalized hospital environments. Their study highlighted how digital transformation enhances data accessibility, patient satisfaction, and workflow efficiency, while also identifying challenges such as training needs and system adaptability.

Al-Kahtani, Al-Moteri, and Alshahrani (2023) [4] evaluated the impact of Hospital Information Systems (HIS) in improving patient care quality. Their study emphasized that digital HIS not only reduce medical errors but also improve engagement by linking systems with mobile integration for timely patient notifications. This aligns with the concept of delivering real-time communication to patients about appointments, prescriptions.

Etemadi et al. (2022) [5] conducted a systematic review of healthcare recommender systems, focusing on real time integration and implementation. The study highlighted how intelligent recommendation engines can personalize treatment, guide patients toward lifestyle changes, and provide actionable insights to clinicians. Such integration is particularly useful for platforms aiming to improve patient engagement and personalized care delivery. More recently, research into chatbot applications has shown promising results. [2]. A study on Chatbot-Assisted Care Management (2022) demonstrated how chatbots help monitor post-discharge patients with chronic conditions, leading to better compliance, more frequent follow-ups, and improved rapport with care managers. This reinforces the potential of integrating chatbot support into hospital systems to extend patient care beyond hospital visits.

Kim et al. (2025) [6] presented the development of an intelligent hospital information chatbot, which integrates with hospital workflows to provide patient registration, appointment updates, departmental recommendations, and medical information. Their findings suggest that conversational agents can serve as effective virtual assistants in healthcare, reducing administrative workload and improving patient accessibility to hospital services.

Lluch (2011) [7] conducted a review highlighting organizational barriers faced by healthcare professionals in adopting health information technologies. The study emphasized that lack of training, resistance to change, and inadequate infrastructure remain major challenges in implementing new systems. This insight is important for projects like paperless OPD management systems, where stakeholder acceptance and ease of use determine success.

The Impact of E-Hospital and Paperless Systems on Patient Care (2018) [8] emphasized the benefits of implementing hospital information systems (HIS) and paperless workflows. The study found that digital systems enhance hospital efficiency by reducing the administrative burden on staff, while also improving patient satisfaction through centralized record-keeping and easy data accessibility. These insights strongly support the design of paperless OPD systems, showing that digitization not only benefits hospitals operationally but also enhances transparency and patient trust.

Tommis et al. (2009) [9] explored medication management routines from the perspective of people with chronic conditions. Their study revealed that patients often face difficulties in organizing, remembering, and adhering to medication schedules. The findings highlight the need for healthcare systems to provide supportive tools, reminders, and streamlined workflows that assist patients in managing long-term treatments. For paperless OPD systems, integrating features such as digital prescription tracking and automated reminders can directly address these challenges, improving treatment adherence and overall patient well-being.

Kijsanayotin, Pannarunothai, and Speedie (2009) applied the UTAUT model [10] to identify factors influencing adoption of health information technologies in Thailand's community health centers. Their findings demonstrated that factors such as performance expectancy, effort expectancy, and social influence play a significant role in adoption. This underscores the importance of designing healthcare platforms that are both user-friendly and beneficial to clinical outcomes.

Premkumar and Kosalram (2013) [11] analyzed the changing trends in e-hospital management and hospital information systems. Their work demonstrated that digitization leads to improved efficiency, better patient record management, and streamlined hospital work flows, which supports the transition toward paperless systems in healthcare institutions.

Additionally, [12] mobile health (mHealth) platforms play a crucial role in ensuring communication between hospitals and patients. A 2017 study published in JMIR mHealth and uHealth demonstrated how mobile-based notifications significantly improve treatment adherence and hospital-patient communication, laying the foundation for modern notification systems integrated into paperless hospital workflows.

Practical implementations, such as PrescoIPD [1], demonstrate how a Paperless In-Patient Department Management System can function effectively in real world hospital setups. By eliminating manual paper work, these platforms enable the centralization of patient records, ensuring that information is consistently accessible to both doctors and administrative staff. Furthermore, such systems simplify hospital workflows by digitizing admission processes, treatment updates, and discharge procedures, making operations more efficient and less error-prone. The success of PrescoIPD highlights the growing potential of paperless hospital systems to deliver streamlined operations, improved

communication among stakeholders, and enhanced quality of care for patients.

Thus, for projects like paperless OPD management systems, the focus is not just on digitization but also on improving accessibility, reliability, and patient engagement to ensure that healthcare services become more efficient, transparent, and inclusive. Taken together, these studies underline the importance of digital hospital systems that integrate paperless workflows, mobile-linked notifications, and intelligent chatbot support, providing both theoretical and practical backing for developing platforms that enhance efficiency, transparency, and overall patient experience in modern healthcare environments.

III. METHODOLOGY

The system methodology revolves around digital workflows for hospital operations. It includes two main panels: an Admin Panel for registration and records, and a Doctor Panel for diagnosis, prescriptions, and updates.

The doctor's portal can include a comprehensive scheduling feature that allows doctors to manage their availability efficiently. Using a calendar interface, doctors should be able to mark their working hours, indicate periods of unavailability. This system ensures that doctors have full control over their schedules and can update them in real-time. On the administrative side, the hospital admin should have access to the consolidated calendar view of all doctors, enabling them to monitor individual doctor availability, plan appointments effectively, and allocate resources accordingly. To ensure active communication, mobile-linked notifications are integrated, allowing patients to receive real-time updates. In addition to these, the chatbot operates as a virtual assistant within the system, answering frequently asked question, and providing instant responses about services such as guidance on symptoms and possible related diseases and hospital information.

The overall system is developed on a modern web-based architecture that ensures scalability and flexibility.

A. Tech Stack and Modules

- Frontend: React.js, Tailwind CSS
- Backend: Flask (Python) for workflow management and APIs
- Database: MongoDB for scalable, secure storage
- Notifications: SMS APIs integration for real-time communication
- ✓ Chatbot Integration:
 - ✓ Framework: Next.js 14 (App Router, TypeScript)
 - ✓ Database: MongoDB (native driver)
 - ✓ AI Integration: Groq API with Llama 3.1-8b instant model
 - ✓ UI: React 19 + shadcn/ui + Tailwind CSS v4
 - ✓ Forms: React Hook Form + Zod validation

B. Algorithm used in Chatbot

Since the chatbot integrates with the Groq API using the LLaMA 3.1-8B-Instant model, the core algorithm is based on the Transformer architecture, which is a deep learning model developed for natural language processing.

- Transformer-based Deep Learning Model: LLaMA (Large Language Model Meta AI) is a transformer-based large language model.
- Self-Attention Mechanism: The key algorithm that allows the model to “focus” on relevant parts of the input sequence while processing text.
- Tokenization and Embeddings: Input text is broken into tokens, which are then mapped into numerical vectors (embeddings) that the model can understand.
- Auto-regressive Generation: The model predicts the next token step-by-step, using a probability distribution conditioned on the previous tokens.

IV. MODELING AND ANALYSIS

The workflow of a paperless OPD system can be modeled as follows:

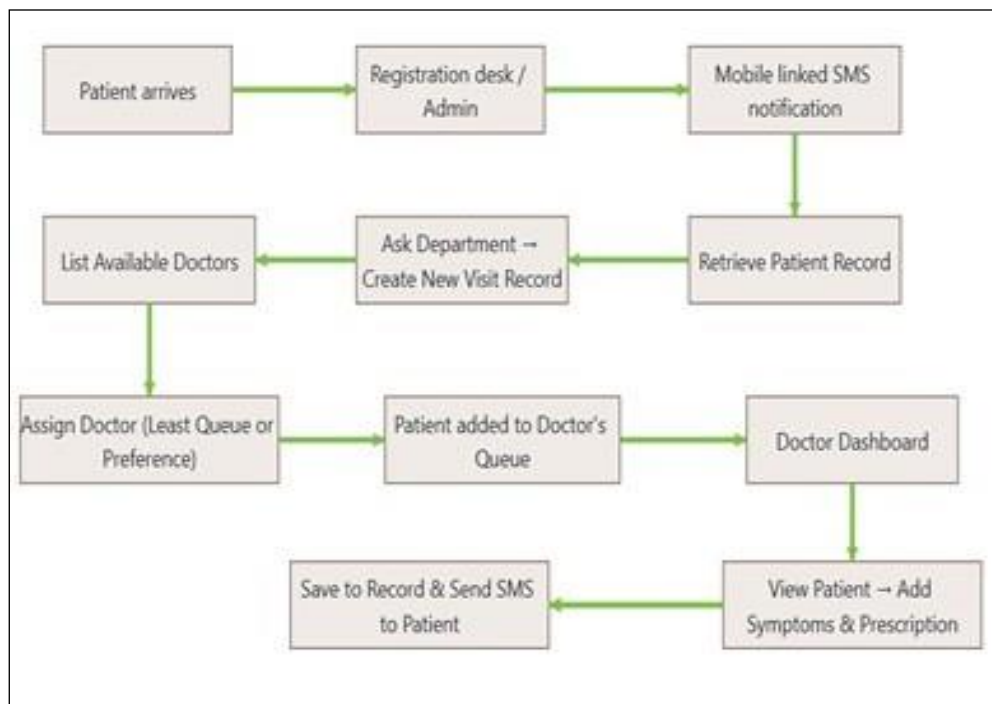


Fig 1: Workflow Diagram

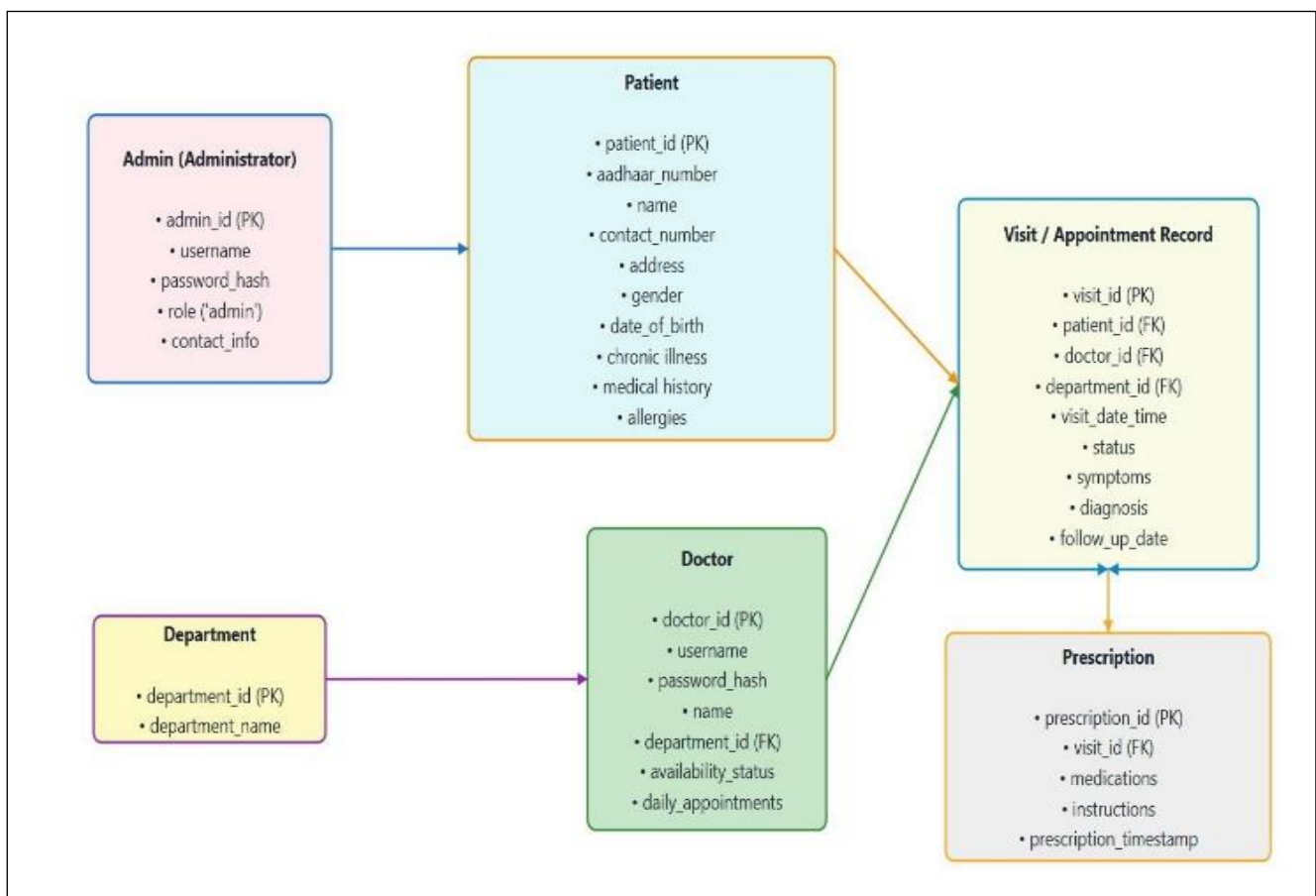


Fig 2: Entity-Relationship(ER) Diagram

- A patient registers through the Admin Panel by providing essential details such as name, contact information, allergies, medical history, and other relevant health records. The Admin can also view doctors' schedules in real time through the system to check their availability for OPD, making the registration process faster and more efficient. In addition, the Admin has the ability to add or remove doctors, update their information, and manage their login credentials such as passwords. For better record management, each patient's visit history or medical data can also be printed individually by the Admin whenever required.
- A patient selects the category of specialization relevant to their condition, and the system displays doctors available in that category.
- In the Doctor's Panel, the doctor accesses patient records digitally, prescribes medicines, and updates treatment information in real time. Moreover, doctors can mark their availability or absence using a calendar format, which is also visible to the Admin, enabling them to verify doctor availability and manage patient assignments effectively.
- Patients are instantly notified on their mobile devices when an appointment is booked. Additionally, the chatbot can optionally assist with symptom-related queries and possible conditions if needed.
- All records are securely stored in the digital system for future reference and easy retrieval.

V. RESULTS / EXPECTED OUTCOMES

The expected benefits of paperless OPD systems include:

- **Improved Transparency via Notifications:** Patients receive mobile notifications about booked appointments and treatment updates, creating transparency in the hospital workflow.
- **Improved User Support via Chatbot Assistance:** The chatbot provides instant responses to common queries. Patients can ask about lifestyle adjustments based on allergies or chronic illnesses, or check details about their last visit, ensuring a more personalized and supportive healthcare experience.
- **Doctor Scheduling with Calendar Integration:** Doctors benefit from a dedicated scheduling view within their portal, enabling them to manage appointments effectively. This structured calendar helps optimize doctor availability and minimizes appointment overlaps, leading to smoother patient flow.
- **Centralized Patient History Repository:** All patient details are securely stored in one place, allowing doctors quick access to medical history and enabling smoother long-term care.
- **Better Coordination Between Patients, Doctors, and Admins:** The integration of admin and doctor panels, combined with instant updates, ensures efficient communication and seamless collaboration between stakeholders.

Patient Report

← Back to Dashboard Logout

Rohan Sharma
Patient ID: PT0006

+ Add New Record Print Report

Basic Information	Medical Information	Visit Statistics
Age: Not specified years Gender: Male Phone: 8765432190 Address: 14, MG Road, Indiranagar, Bengaluru, Karnataka – 560038	Allergies: Pollen allergy Chronic Conditions: Hypertension (High BP) Blood Group: Not specified	Total Visits: 1 Last Visit: Aug 27, 2025, 05:51 PM Next Follow-up: None scheduled

Complete Visit History All Departments All Years

Aug 27, 2025, 05:51 PM Dr. Suresh Malhotra - General Chief Complaint: General consultation Visit completed on Aug 27, 2025, 05:51 PM	assigned
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Fig 3: Patient Report

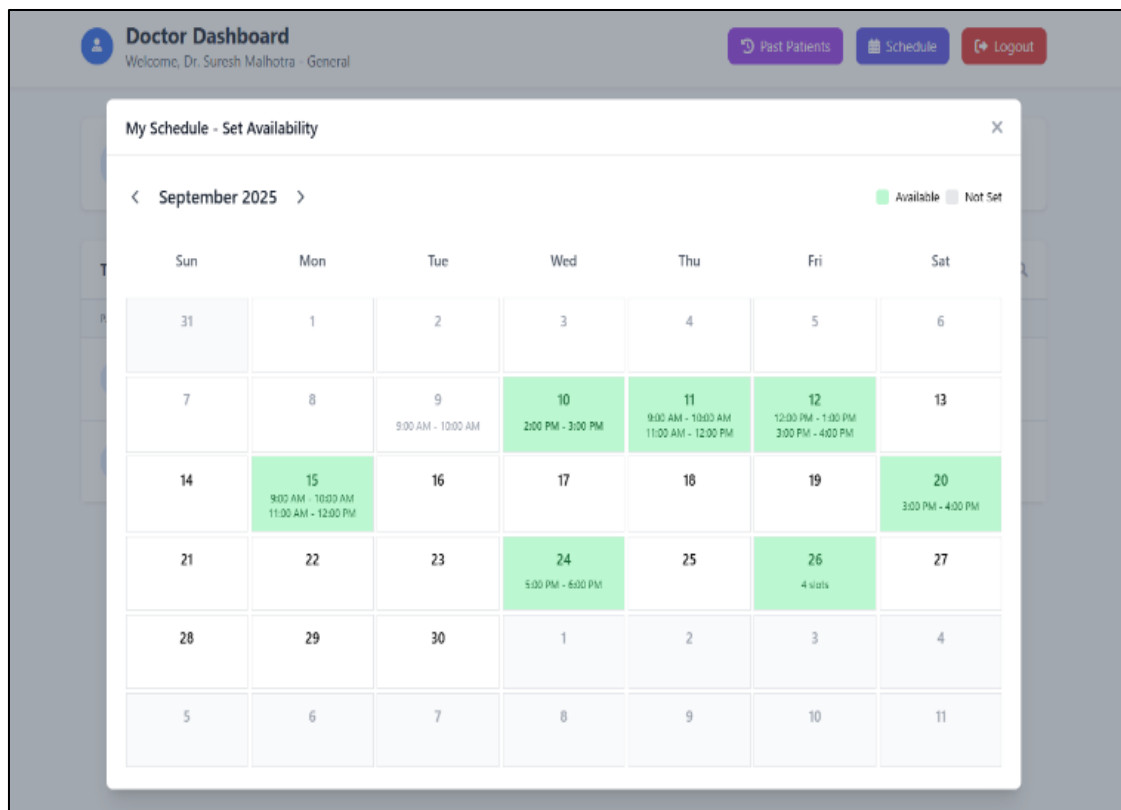


Fig 4: Doctor's Dashboard with Calendar-Based Scheduling

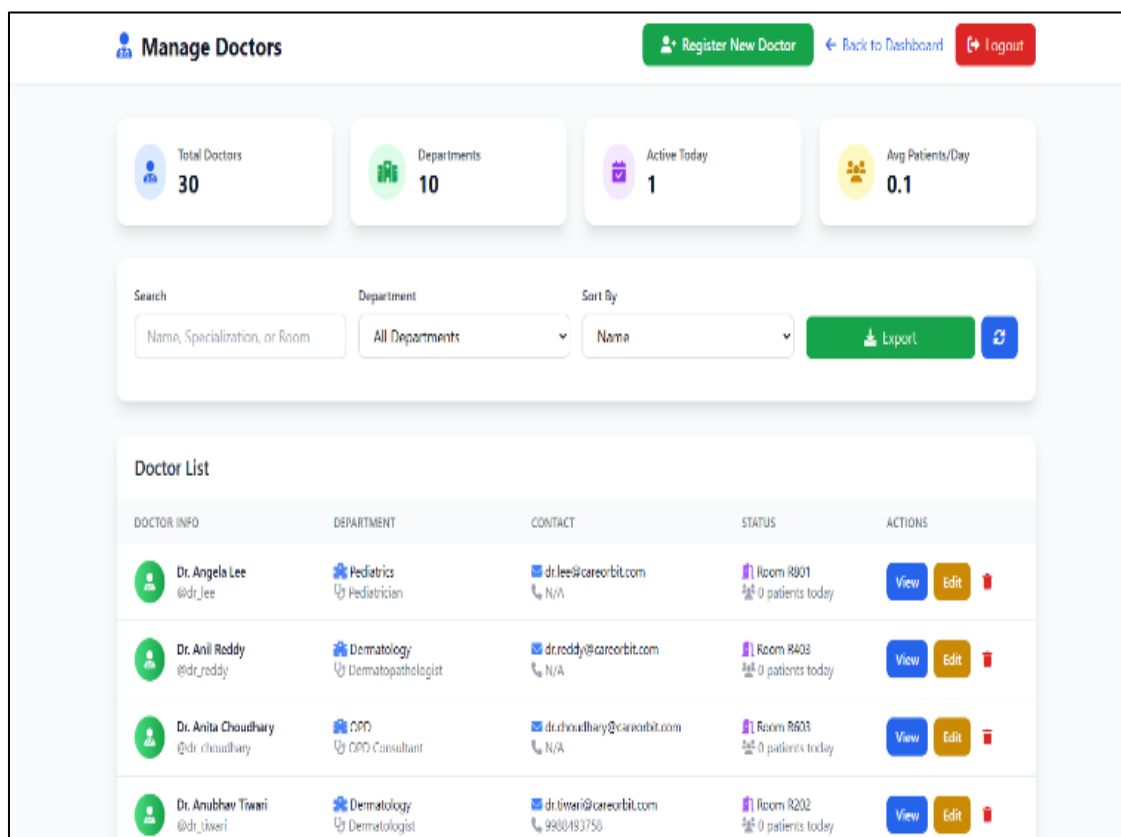


Fig 5: Manage Doctors

The screenshot shows a web interface titled "Send SMS Notification" with a "Back to Dashboard" link. The main form is titled "Send Appointment SMS" and includes the instruction "Send SMS notifications to patients about their appointments". The form contains the following fields: "Phone Number" (with a red asterisk) containing "+919328454917" and a subtext "Include country code (e.g., 191 for India)"; "Queue Number" (with a red asterisk) containing "12"; "Patient Name" containing "Keshish Bhal"; "Doctor Name" containing "Dr. Malhotra"; and "Appointment Time" containing "3:30 pm". Below these fields is an "SMS Preview" section stating: "The SMS will be automatically formatted with appointment details and sent to the patient." At the bottom right of the form are "Cancel" and "Send SMS" buttons.

Fig 6: SMS Appointment

The screenshot displays the "Welcome, Aditya Patel" interface for the "CareOrbit Healthcare Assistant". It includes a "Logout" button. The "Your Profile" section lists: Contact: 9018273645, Date of Birth: 2009-04-03T00:00:00.000Z, Gender: Male, Chronic Illness: Asthma, and Allergies: Pollen allergy, Penicillin. The "Healthcare Assistant Chat" section shows a conversation: the assistant greets Aditya Patel at 09:59 pm; the user asks "what should I eat" at 10:00 pm; the assistant provides dietary advice for asthma and allergies at 10:00 pm; the user asks "which doctor did I meet?" at 10:00 pm; and the assistant responds with visit details.

Fig 7: Chatbot

VI. FUTURE SCOPE

The proposed paperless OPD system lays a strong foundation for digital hospital management. However, there are several opportunities for future enhancements:

- **Advanced Chatbot Capabilities:** The chatbot can evolve into a more intelligent AI-powered virtual assistant, capable of handling complex medical queries. By training the model with inputs and feedback from doctors, the system ensures that recommendations and responses are medically accurate, reliable, and aligned with professional health care practices.
- **Appointment Management:** Automated reminders and follow-up scheduling can be introduced to improve treatment adherence and reduce the chances of missed appointments or delayed treatments.
- **Multi-channel Notifications:** Expanding beyond traditional SMS and Email by integrating WhatsApp, push notifications, and in-app alerts. This multi-channel approach ensures that patients never miss critical updates regarding their appointment bookings.

VII. CONCLUSION

Paperless OPD systems mark a step forward in building smarter, patient-centered healthcare. The core idea is to reduce paperwork, save time, and create smoother hospital workflows that benefit both patients and medical staff. The use of calendar-based scheduling, instant patient notifications, and chatbot support ensures better coordination and patient engagement. By combining digital record-keeping, instant notifications, and chatbot-assisted interaction, the system focuses on making healthcare more accessible, transparent, and reliable. Our project was developed with the vision of improving hospital-patient communication and reducing manual dependency. Through real-time updates, guided registration, and secure storage of records, the system ensures that patients remain informed and engaged throughout their care journey.

In conclusion, a paperless OPD system is not just a digital upgrade but a transformative approach to healthcare management, where the motto is to simplify processes, enhance trust, and ultimately deliver better outcomes for patients and hospitals alike.

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