

# **AI-Integrated Hospital Management System with Role-Based Access Control**

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**Abstract:** *This project focuses on building a fully functional Hospital Management System (HMS) aimed at simplifying day-to-day hospital activities through digital tools. It offers secure, role-based access tailored to administrators, doctors, and receptionists, allowing them to efficiently manage appointments, patient details, lab results, and prescriptions. A built-in AI-powered chatbot enhances user interaction by instantly answering queries and helping users navigate the system with ease. Designed with scalability, security, and ease of use in mind, this HMS is well-suited for small to medium healthcare centers looking to modernize and streamline their operations*

**Keywords:** Hospital Management System (HMS), Web-based application, Digital healthcare, Role-based access control (RBAC), AI-powered chatbot

## **I. INTRODUCTION**

In recent years, the healthcare industry has undergone a significant transformation due to the advancement of digital technologies. One of the most impactful innovations in this space has been the development and deployment of Hospital Management Systems (HMS), which streamline and automate the various day-to-day administrative, clinical, and operational activities in healthcare institutions. As hospitals and clinics strive to deliver high-quality care while managing increasing patient loads, maintaining efficiency, security, and accuracy in hospital operations becomes critically important. Traditionally, hospital workflows have been managed through manual processes and paper-based systems, which are prone to human error, inefficiencies, delays, and data redundancy. These legacy systems are not only time-consuming but also difficult to manage and scale, especially in the face of emergencies or a sudden influx of patients. The need for a robust, centralized, and intelligent management system is therefore essential to meet modern healthcare demands. This project presents the design and development of a fully functional web-based Hospital Management System that aims to overcome the limitations of traditional methods. The system is designed to automate essential hospital functions such as patient registration, appointment scheduling, doctor allocation, prescription generation, and lab report management. A key highlight of the system is the incorporation of a built-in AI-powered chatbot that enables real-time assistance and improves user engagement. This chatbot supports hospital staff and patients by addressing queries related to appointments, medical records, and system navigation..

## **II. LITERATURE SURVEY**

Hospital Management Systems (HMS) have evolved from basic patient record systems to complex platforms integrating clinical, administrative, and financial functions. Several studies and existing implementations have paved the way for advanced HMS design, but gaps still remain, particularly in user accessibility, modularity, and interactive assistance.

**Traditional Systems and Their Limitations:** Early HMS implementations primarily focused on digitizing paper records to streamline operations. Systems such as MEDITECH and EPIC are well known in large hospital networks but often suffer from high cost, steep learning curves, and limited flexibility for small to mid-scale facilities. A study by Sharma et al. (2018) explored the impact of basic HMS in reducing hospital administrative workload. However, the



system lacked interactivity, relied heavily on manual data input, and had a rigid architecture, making it difficult to scale or customize.

**Modular and Role-Based Access Systems:** Recent research has focused on modular system design, allowing for better scalability and maintainability. In "A Secure Modular Healthcare System with Role-based Access" (Patel & Kumar, 2020), the authors proposed an HMS with role based authentication, but the system was limited to core functionalities like patient records and billing without communication features. Another study by Banerjee et al. (2021) emphasized the need for secure and auditable access controls in health IT systems to comply with regulations like HIPAA. However, they noted that many systems lack real-time interactivity, which affects usability for patients and staff alike.

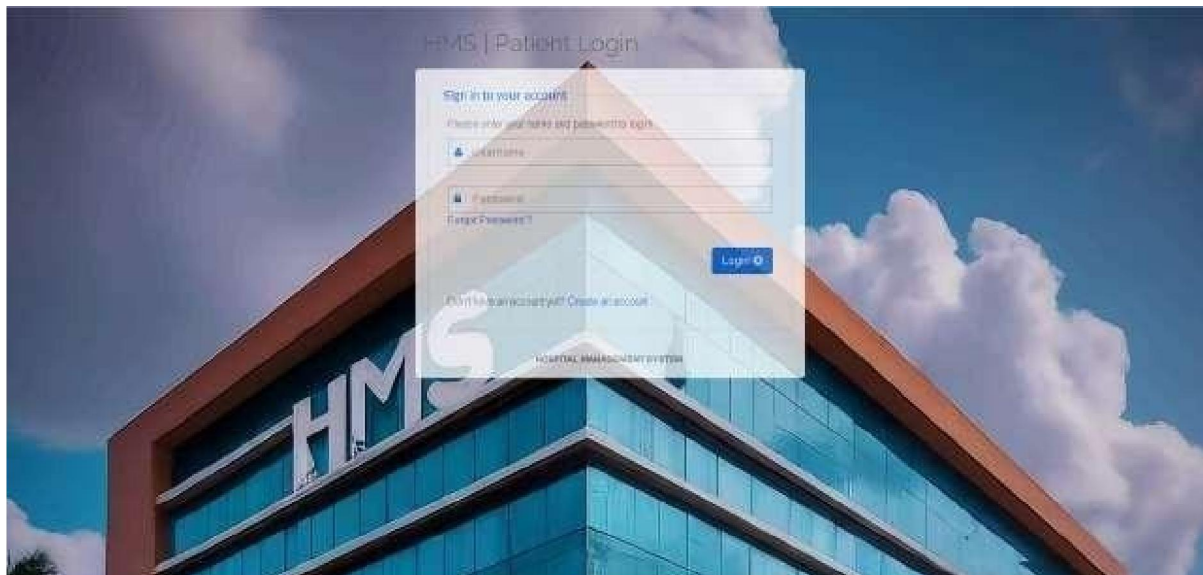
**Integration of Artificial Intelligence and Chatbots:** The integration of AI-powered chatbots in healthcare is gaining popularity. In 2020, Chatterjee et al. introduced a health assistant chatbot to help patients understand their symptoms. However, it operated independently and was not integrated within any broader HMS framework

### III. METHODOLOGY

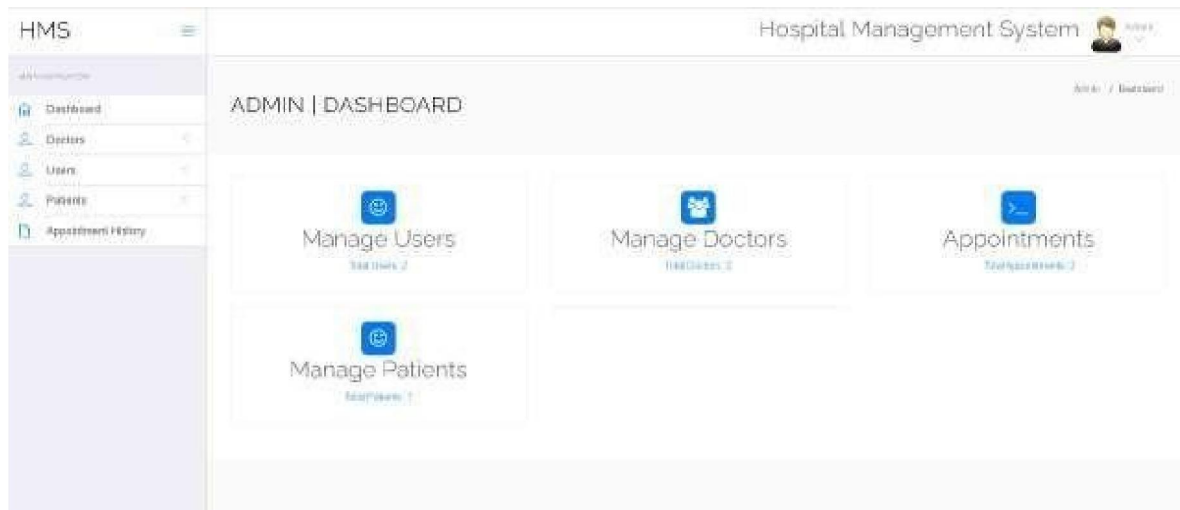
The development of the Hospital Management System was carried out using a modular and iterative approach based on the Agile development model. Initial requirements were gathered by analyzing typical hospital workflows and defining the roles of key stakeholders—administrators, doctors, and receptionists. The system aimed to streamline hospital operations by providing secure access, efficient patient data management, appointment scheduling, prescription handling, and lab report management, along with chatbot-based user support. The system architecture was designed using a three-tier model consisting of the presentation layer, application layer, and data layer. Role-based access control (RBAC) was implemented to ensure that users could only access functionalities relevant to their role. The frontend was developed using HTML, CSS, and JavaScript, while the backend was implemented in Python using the Flask/Django framework. MySQL was used for structured data storage, and the chatbot was built using Python with rule-based logic to assist users with basic queries such as booking appointments or accessing reports.

### IV. EXPERIMENTAL RESULTS

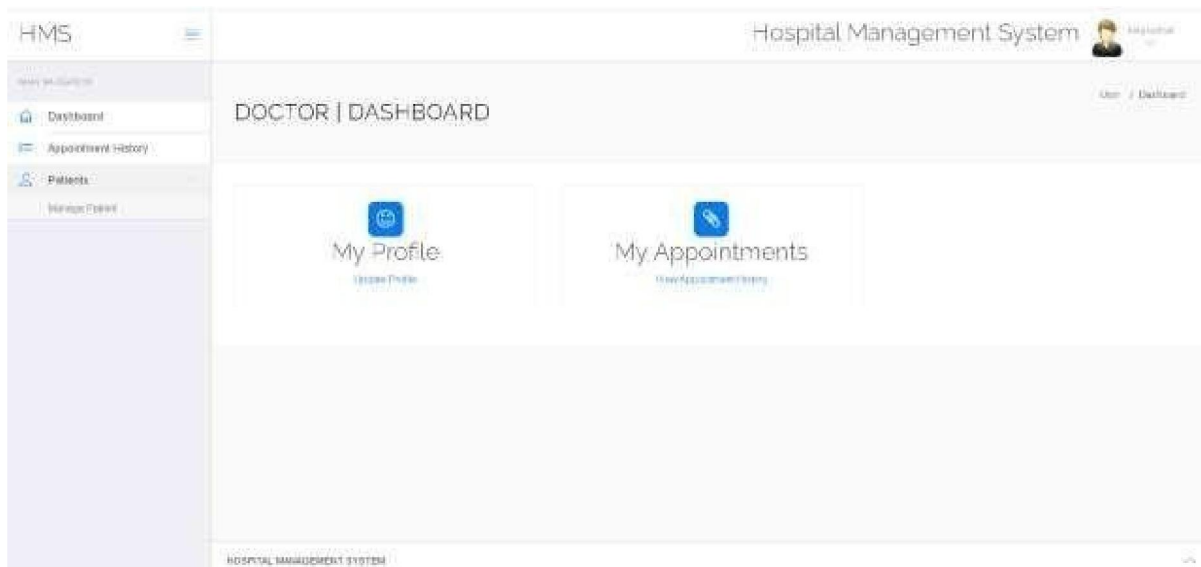
**Login Portal** The login portal functions as a secure gateway for user authentication, implementing role-based access control (RBAC) to ensure that each user accesses only the features relevant to their role. It offers dedicated login paths for administrators, doctors, and receptionists, all within a consistent and user-friendly interface that promotes a smooth experience across all user types.



**Admin Dashboard** The admin dashboard serves as the central management interface for hospital administrators. It allows for full control over the hospital's data, including managing user roles, scheduling, and overseeing patient records.



**Doctor Dashboard** Doctors benefit from an optimized dashboard that provides quick access to patient histories, appointment schedules, and prescription generation tools. The dashboard is task oriented, focusing on the functionalities doctors require, such as reviewing patient records, adding notes, and generating prescriptions in real-time.



**Chatbot Interface** The integrated AI-powered chatbot assists hospital staff by answering routine queries and providing support for booking appointments, accessing patient records, and more. Using natural language processing (NLP), the chatbot reduces the workload of hospital staff by offering 24/7 support, allowing users to resolve common issues quickly.





## V. CONCLUSION

The developed Hospital Management System (HMS) offers an efficient, secure, and user-friendly solution for managing key hospital operations such as patient registration, appointments, doctor assignments, and departmental tasks. With role-based access control, a centralized database, and an integrated AI-powered chatbot, the system significantly improves workflow efficiency and data accessibility for hospital staff. It consolidates multiple functionalities into a single platform and delivers a seamless user experience. Although successfully implemented, the system has potential for future enhancements, such as integration with electronic health records (EHR), advanced analytics, and expanded user roles like nurses and lab technicians, making it a scalable and flexible solution for modern healthcare needs.

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