Hospital Automation System

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Abstract:
A Hospital Automation System is a computer-based solution designed to improve hospital efficiency and accuracy. The system automates essential functions such as patient registration, appointment scheduling, billing, pharmacy management, and report generation. By integrating all hospital activities into one digital platform, it eliminates redundant manual work, reduces human errors, and provides faster access to patient data. The system enhances transparency, data security, and patient satisfaction while supporting future scalability with modules like online consultation. This review paper examines existing research, identifies the challenges in traditional hospital management systems, evaluates modern automation technologies, and discusses implementation methodologies for an efficient healthcare management system.

Keywords: Hospital Management, Automated Healthcare System, Digitalization, Patient Data Security.

1. INTRODUCTION

The healthcare sector is one of the most vital parts of any nation, and managing hospital operations efficiently is essential for providing quality medical services. Traditional hospital management systems rely on manual record keeping, paper files, and human communication between departments, which often lead to delays, data duplication, and human errors. With the growing number of patients and hospital data, manual systems are no longer effective in maintaining accuracy or speed.

To address these challenges, the Hospital Automation System has been developed to automate and digitalize all major hospital functions such as patient registration, doctor appointments, billing, and pharmacy management. The system integrates all modules on a single web-based platform that allows real-time data sharing and smooth coordination among departments.

The proposed system includes multiple modules — patient management, doctor scheduling, pharmacy management, and reporting. It ensures that all hospital processes are streamlined and accessible +online or through mobile devices. This technological shift not only improves hospital administration but also enhances patient experience and trust.

2. LITERATURE REVIEW

In recent years, hospital management has become a major area of research due to the growing demand for accuracy, efficiency, and better patient care. Traditional manual systems often lead to delays, human errors, and data duplication. Therefore, researchers have proposed several automation models to make hospital operations faster and more reliable.

Dr. R. Naveen and S. A. Sivakumar [1] developed an automated hospital management model aimed at reducing manual errors in maintaining patient records and billing. Rajesh Sharma [2] emphasized the importance of digital transformation in hospitals and suggested centralized data storage to improve coordination among departments. Atsushi Ugajin [3] discussed how automation can reduce hospital workload and improve service quality but also pointed out the lack of proper data security and privacy policies in most systems. Siddhi Darekar and Anushka Dudhane [4] proposed a hospital automation framework focusing on appointment scheduling and report generation, though it lacked real-time updates and scalability. A. Gupta [5] explored smart healthcare systems and emphasized the need for integrated management across hospital departments. M. Kumar [6] discussed challenges related to data protection and highlighted the importance of maintaining confidentiality in healthcare systems. K. Patel [7] introduced a cloud-based hospital management approach to enable data sharing and remote access but identified issues related to internet dependency and

cost. S. Singh [8] examined the role of automation and predictive systems in healthcare. R. Mehta [9] focused on digital workflow systems, highlighting the need for easy-to-use platforms suitable for both technical and non-technical staff.
These studies collectively demonstrate the growing need for scalable, secure, and interoperable hospital automation.

3. METHODOLOGY

Hashing algorithm - Hashing is a technique used to convert data (like ID, email, password) into a **fixed-size value (hash)** called a **hash code (index)** using a **hash function**.
It helps in **fast data searching, storing, and retrieval**.
Simple meaning:
Input (data) → Hash Function → Output (unique code)
Example:
Patient ID: 101
Hash Value: H (101) = 7

Hashing Formula:
h(k) = k mod m
Where:

- **h(k)** = hash value (index)
- **k** = key (e.g., patient ID)
- **m** = size of hash table

Example
If:

- Patient ID = 1234
- Table size (m) = 100

Then:

$$h(1234) = 1234 \bmod 100 = 34$$

So, the patient data will be stored at index **34**
How Hashing Works

1. Take input (Patient ID / Email)
2. Apply hash function
3. Get index value
4. Store data at that index
5. Retrieve data using same function

Types of Hash Functions

1. **Division Method**

$$h(k) = k \bmod m$$

2. **Multiplication Method**

$$h(k) = \lfloor m(kA \bmod 1) \rfloor$$

3. **Mid-Square Method**

- Square the key and take middle digits

Collision in Hashing
When two keys give the same index → **collision**
Example:

- h (1234) = 34
- h (2234) = 34

Both stored at same place → conflict

Collision Handling Techniques

1. **Chaining**
   - Store multiple values in a list
2. **Open Addressing**
   - Linear Probing
   - Quadratic Probing

Time Complexity

Operation	Time
Search	O(1)
Insert	O(1)
Delete	O(1)

Much faster than:

- Linear Search → O(n)
- Binary Search → O(log n)

Use of Hashing in Hospital Automation System

1. Patient Record Searching

- Key = Patient ID
- Hash → Direct access

➢ Instead of searching whole database:

- Direct lookup using hash

2. Login Authentication

- Email + Password → Hashed

Example:

- Password = 123456
- Stored as hash → e10adc3949ba59abbe56e057f20f883e

➢ Secure login system

3. Appointment Management

- Appointment ID → hashed
- Fast retrieval of appointment details

4. Doctor Data Access

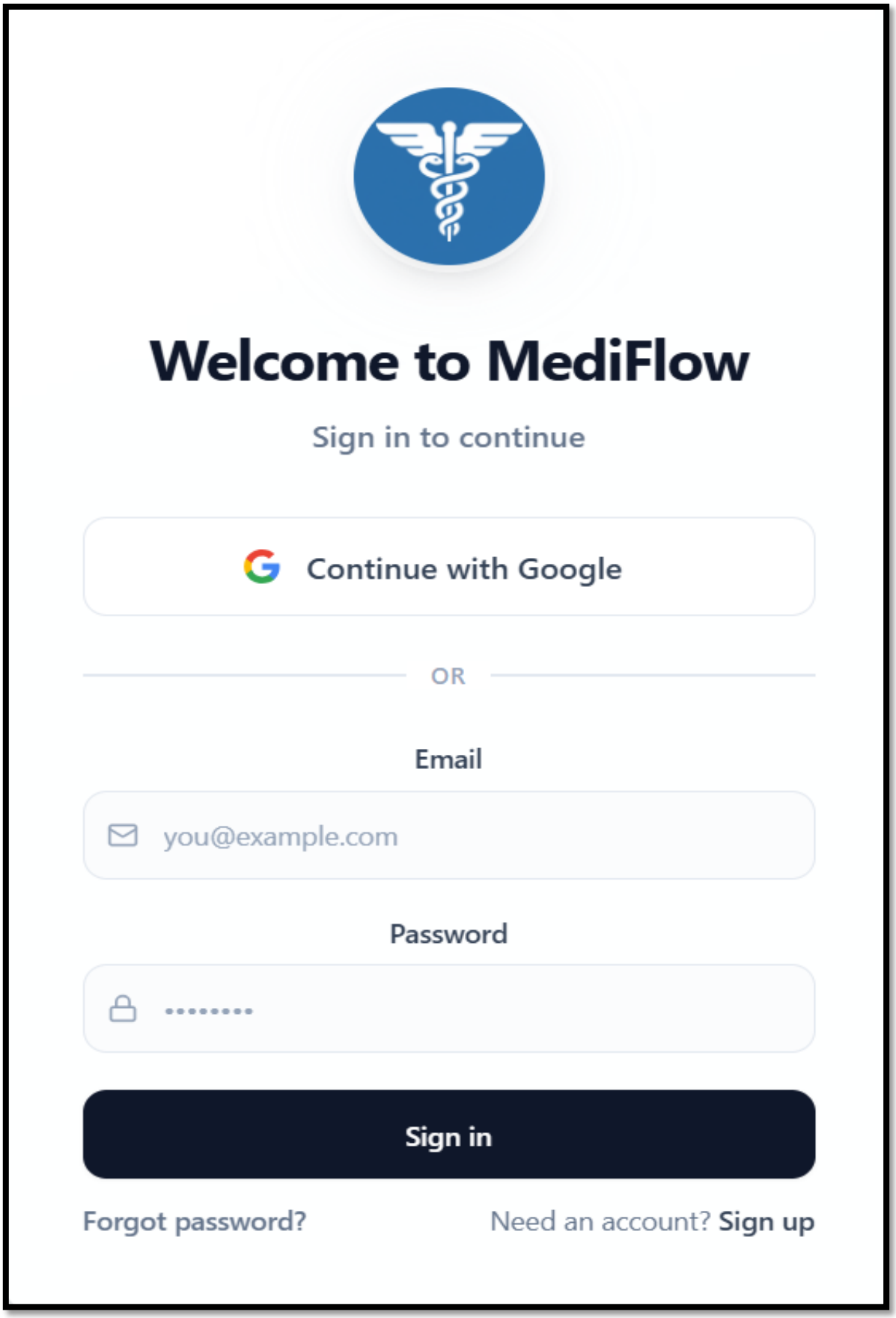
- Doctor ID used as key
- Instant access to schedules and records

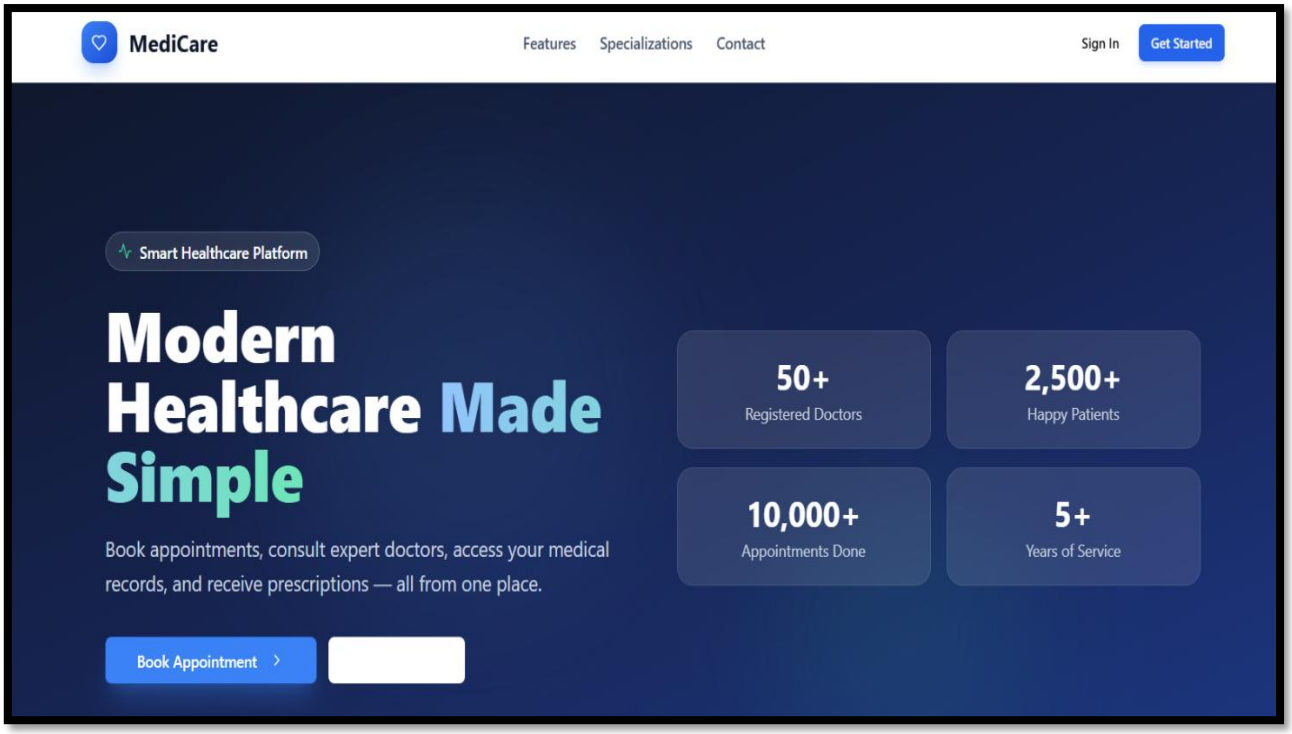
5. Session Management (JWT)

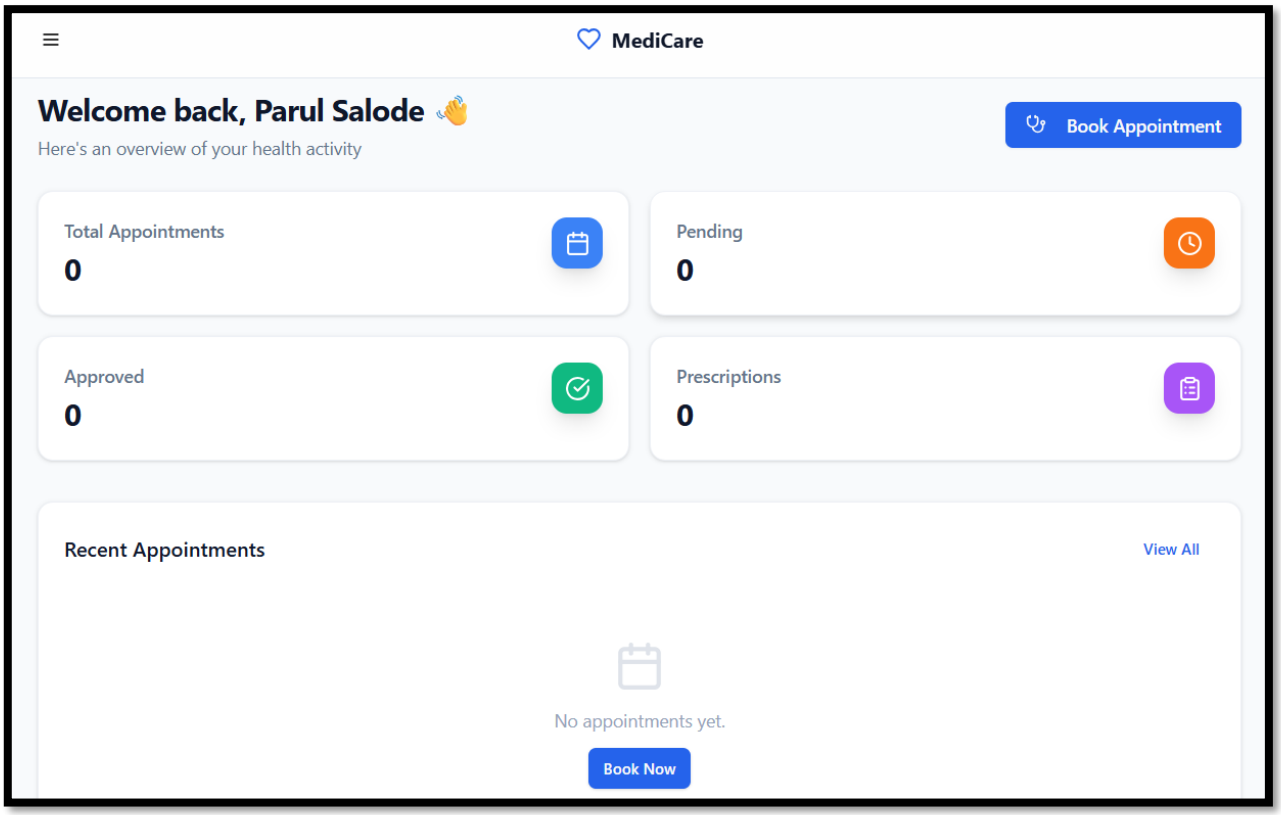
- Token stores hashed user info
- Used for secure API access

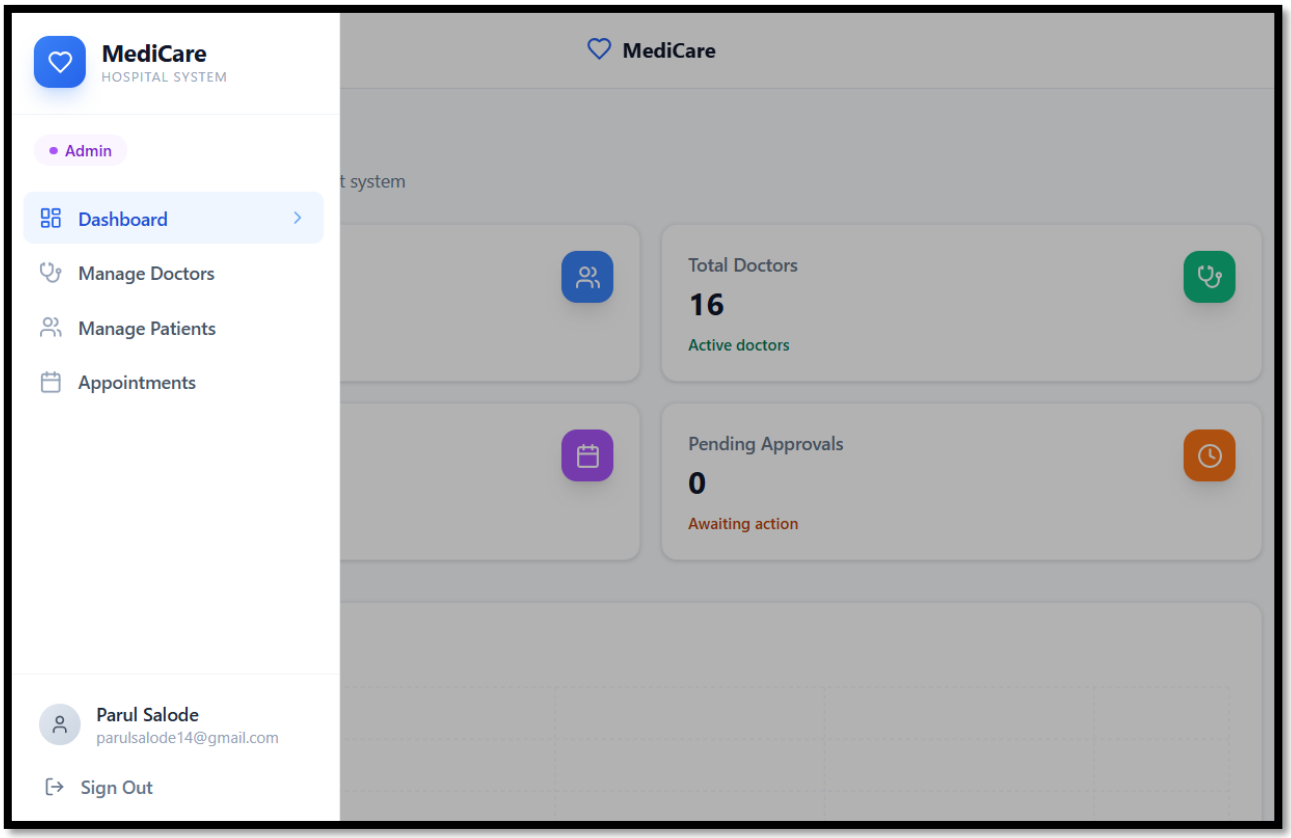
Hashing is the most efficient algorithm used in the Hospital Automation System. It converts keys like patient ID or email into a fixed index using a hash function, enabling fast data access in constant time. It is used in authentication, patient record management, appointment tracking, and database indexing. Compared to other algorithms, hashing provides better performance, security, and scalability, making it the most suitable choice for modern web applications.

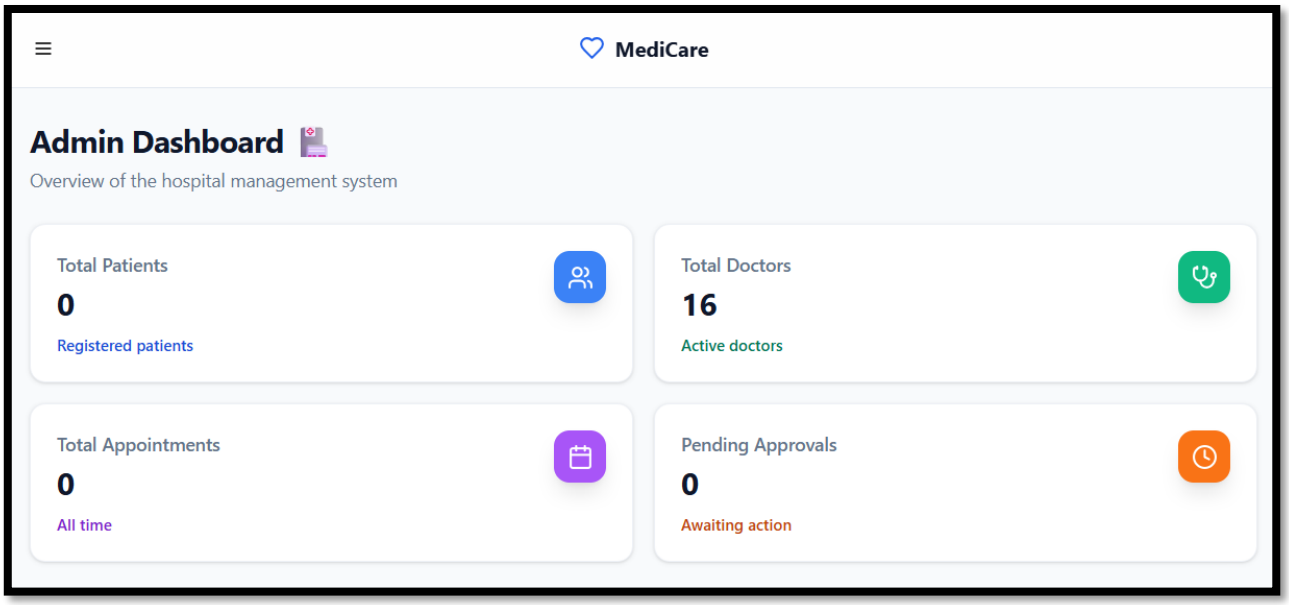
4. OUTPUT

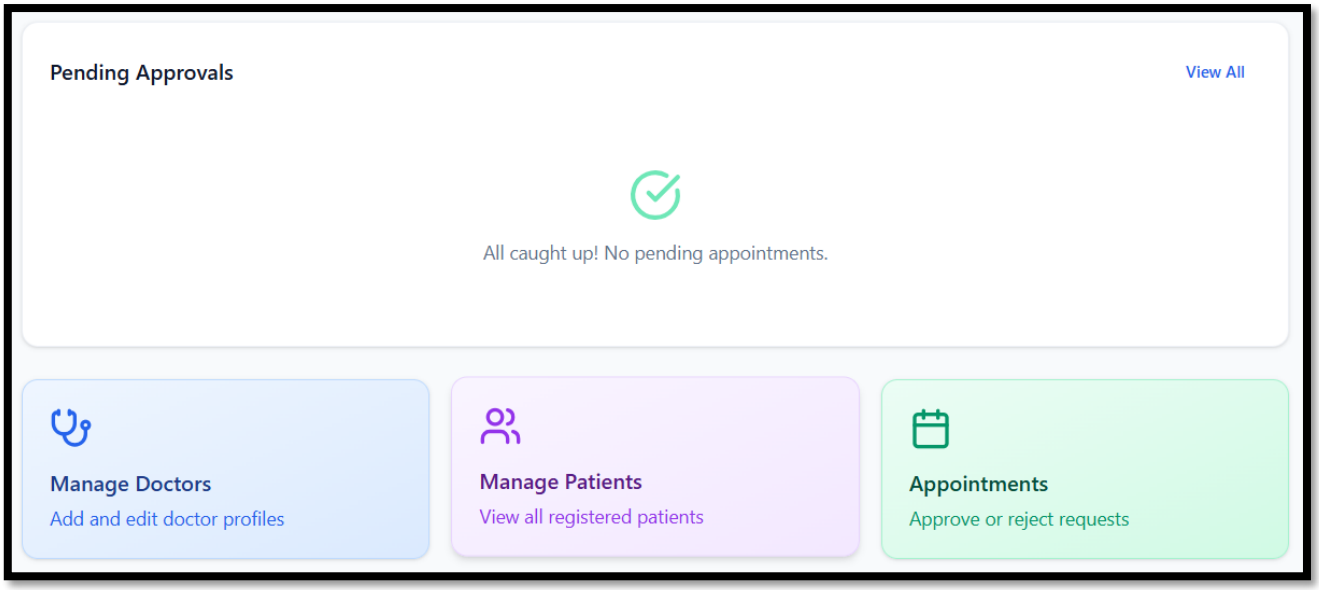

Welcome to MediFlow
Sign in to continue
Continue with Google
OR
Email
you@example.com
Password
Sign in
Forgot password?
Need an account? Sign up

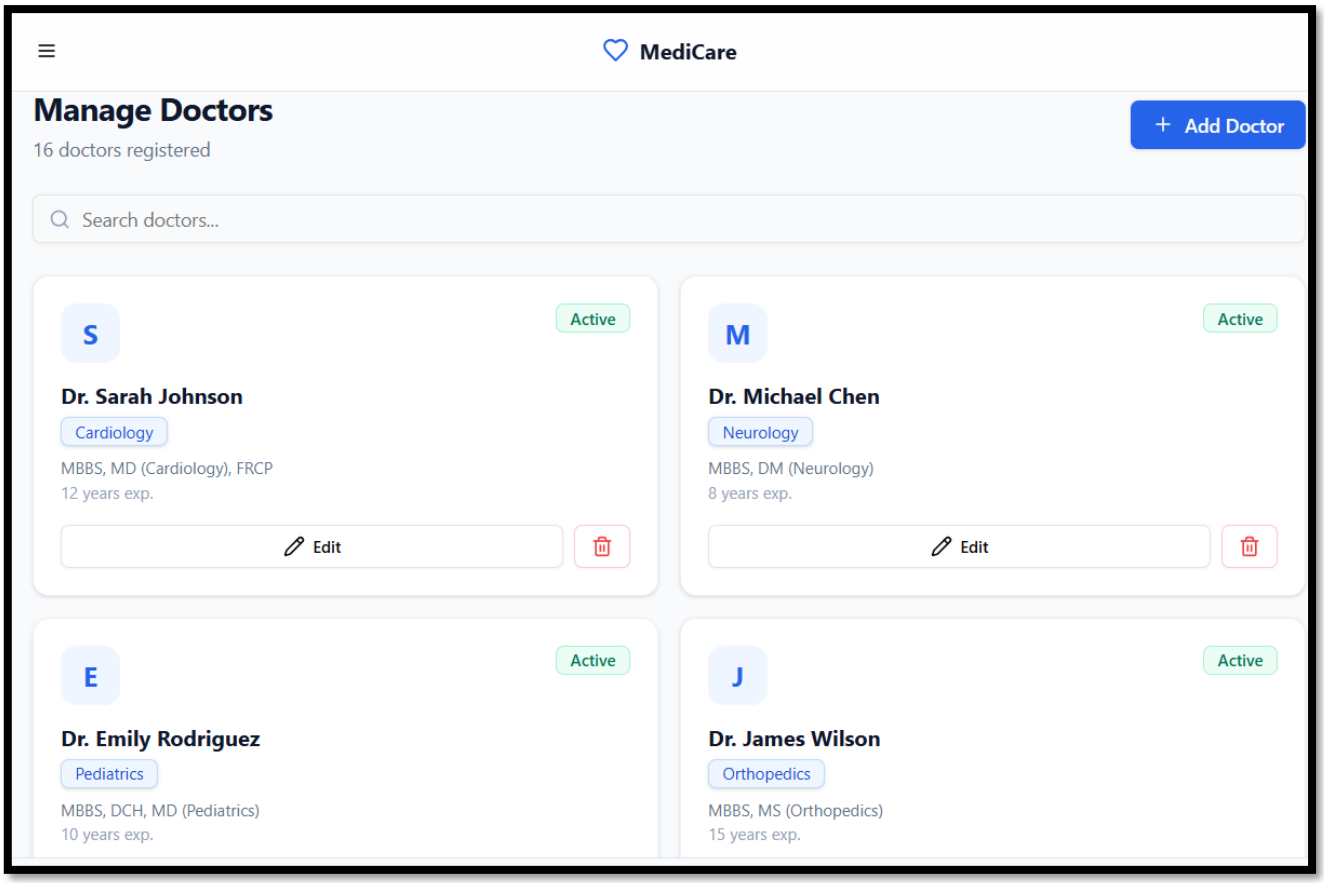

MediCare
Features
Specializations
Contact
Sign In
Get Started
Smart Healthcare Platform
Modern Healthcare Made Simple
Book appointments, consult expert doctors, access your medical records, and receive prescriptions — all from one place.
Book Appointment
50+
Registered Doctors
2,500+
Happy Patients
10,000+
Appointments Done
5+
Years of Service


MediCare
Welcome back, Parul Salode
Here's an overview of your health activity
Book Appointment
Total Appointments
0
Pending
0
Approved
0
Prescriptions
0
Recent Appointments
View All
No appointments yet.
Book Now


MediCare
HOSPITAL SYSTEM
Admin
Dashboard
Manage Doctors
Manage Patients
Appointments
Parul Salode
parulsalode14@gmail.com
Sign Out
MediCare
t system
Total Doctors
16
Active doctors
Pending Approvals
0
Awaiting action


MediCare
Admin Dashboard
Overview of the hospital management system
Total Patients
0
Registered patients
Total Doctors
16
Active doctors
Total Appointments
0
All time
Pending Approvals
0
Awaiting action





9. CONCLUSION AND FUTURE WORK

The Hospital Automation System represents a significant step toward digital healthcare transformation. By replacing manual, paper-based operations with an integrated software system, hospitals can achieve faster, more accurate, and secure management.

The system minimizes human errors, optimizes resource utilization, and enhances patient satisfaction. With its modular design and scalability, it can easily incorporate future technologies like AI and IoT. Overall, this project demonstrates how automation can revolutionize healthcare administration and improve the quality of patient care.

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