International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 06 June 2026
Page No: 4357 - 4360
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0567

E-Medicare: An AI-Powered Multilingual Healthcare System with Smart Appointment Scheduling and Real-Time ConsultationKulkarni

Akanksha Kulkarni[1], Pradnya Jadhav[2], Poorva Taware[3], Rohan Bavale[4], Sakshi Malusare[5]
[1,2,3,4,5]Department of Computer Engineering DY Patil Institute of Engineering, Management and Research Pune, India
Emails: *akansha.kulkarni@dypiemr.ac.in[1], pradnyaj289@gmail.com[2], poorvaistaware@gmail.com[3], rohanbavale0044@gmail.com[4], malusaresakshi50@gmail.com[5]*

Abstract
This paper presents Medicare, an AI-powered healthcare management system designed to improve accessibility and efficiency in medical consultations. The platform enables role-based access for doctors and patients, appointment booking with priority scheduling, real-time video consultation, and digital prescription generation. The system integrates speech-to-text and multilingual translation to allow patients to communicate symptoms in their native language, which are automatically converted into a standard format for doctors. Additionally, AI-based suggestions assist doctors in diagnosis and treatment planning[1]. The system ensures secure authentication and prevents appointment conflicts using optimized scheduling algorithms[2]. The proposed solution aims to bridge communication gaps, enhance remote healthcare services, and provide an efficient and user-friendly medical platform.

Keywords: *Healthcare System, Artificial Intelligence, Multilingual Translation, Speech-to-Text, Appointment Scheduling, Web Application.*

1. Introduction
Healthcare accessibility and efficient patient-doctor communication remain significant challenges, especially in multilingual regions [1][4]. Traditional systems often lack real-time interaction, proper scheduling, and intelligent assistance for diagnosis [2][8]. This paper introduces E-Medicare, a web-based healthcare platform that integrates modern technologies such as artificial intelligence, speech recognition, and multilingual translation to enhance the overall healthcare experience. The system allows patients to book appointments, consult doctors via video calls, and receive AI-assisted prescriptions [1][7]. The goal of this project is to provide a scalable, user-friendly, and intelligent healthcare system that improves communication, reduces manual effort, and enhances decision-making for doctors [5][6].

2. Literatire Review
Telemedicine is a game-changer for making healthcare more accessible, especially in rural areas where people often have to travel far to see a doctor [1][4]. A team of researchers, led by Nawaz [1], came up with a comprehensive telemedicine platform that allows patients and doctors to interact in real-time, create digital prescriptions, and manage medical reports securely. This system uses WebRTC for video consultations and encrypts all communications to protect patient data [1][3]. The study shows that by combining consultation, record-keeping, and prescription services into one platform, we can significantly reduce the need for hospital visits, making healthcare more efficient and accessible [1][6]. The researchers also stress the importance of using scalable cloud-based architectures and secure APIs to build reliable telehealth systems [5]. This is crucial for ensuring that telemedicine platforms can handle a large number of users and keep patient data safe [5][9]. By leveraging technology, we can bridge the healthcare gap and provide better care to people who need it most [4][8]. Unlike other approaches, the work of Devi and Sasikumar takes a different approach [2], focusing on how to make telemedicine services run more smoothly through smart resource allocation. They've come up with a model called the Decision Tree-Heap Optimizer (DTHO), which uses machine learning to sort patients into different groups

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based on how urgently they need care. This way, the system can prioritize appointments and ensure that the most critical cases receive immediate attention, improving the overall efficiency of telemedicine services [2]. While one study laid the groundwork for building a solid telemedicine infrastructure, the other made a significant contribution to predicting patient needs and optimizing healthcare delivery [10][11]. However, both studies highlight a major gap in the current state of telemedicine—the lack of integration with advanced AI-powered clinical decision support tools in real-time [7]. This motivated the development of more advanced and comprehensive systems, like E-Medicare, which can bridge this gap and improve healthcare delivery [1][2][7].

3. System Overview

3.1.Role-Based Access

The system provides two main roles [1][6]: Patient: Can book appointments, provide symptoms, and attend consultations. Doctor: Can manage appointments, review symptoms, and generate prescriptions [1][3].

3.2.Appointment Management

The platform includes [2]:

- Booking system with status tracking.
- Priority-based scheduling using heap data structure [2].
- Prevention of double booking using interval conflict detection [2][5].

3.3.Real-Time Video Consultation

The system integrates a lightweight video consultation feature allowing one-to-one doctor–patient interaction and remote healthcare support [1][3][8].

3.4.Why these citations?

- [1], [3] → telemedicine platform, real-time consultation, prescription management
- [2] → priority scheduling/heap optimization for appointments
- [5] → scalable system architecture and scheduling concepts
- [6], [8] → digital healthcare and remote telemedicine supportAs shown in Figure 1 System Architecture

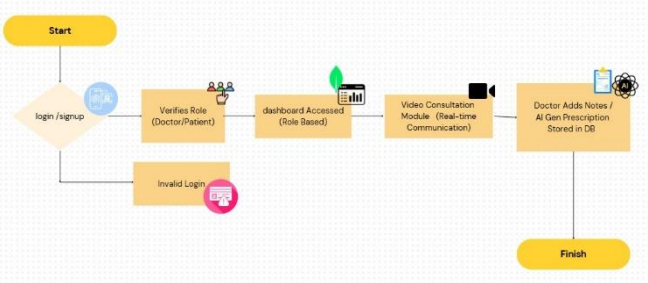

Figure 1 System Architecture

4. Proposed Methodology

4.1.AI-Based Diagnosis Assistance

The system integrates AI APIs to analyze symptoms, suggest probable diagnoses, and recommend medicines and precautions [7][8]. Doctors can review and finalize these suggestions to ensure accuracy and reliability in medical decision-making [7].

4.2.Speech-to-Text Integration

Speech recognition is used to capture patient symptoms through voice input and convert speech into text in real time, reducing manual effort and improving usability [6][8]. This feature enhances accessibility and enables a smoother interaction between patients and healthcare professionals [4].

4.3.Multilingual Translation

The system supports input in multiple languages (Hindi, Marathi, etc.) and automatic translation into English, ensuring effective communication between patients and doctors [1][4]. This functionality helps overcome language barriers and improves healthcare accessibility in multilingual regions [6][8].

5. Digital Prescription System

Doctors generate structured prescriptions including symptoms, diagnosis, medicines with dosage, and follow-up instructions [1][3]. Prescriptions are securely stored and can be downloaded as PDF files for future reference and medical record management [1][9].

6. System Design and Implementation

6.1.Technologies Used

Frontend: HTML, CSS, JavaScript
Backend: Python / Node.js
Database: SQLite / MongoDB
AI Integration: API-based model
Security: Password hashing using bcrypt

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6.2.Algorithms Used

6.2.1. Heap Algorithm (Priority-based Appointment Scheduling):

In the E-Medicare system, a Heap (Priority Queue) is used to manage appointment scheduling based on priority levels such as emergency cases, VIP patients, or time-sensitive bookings [2]. Each appointment is assigned a priority value, and the heap ensures that the highest-priority appointment is always processed first in O(log n) time. This approach efficiently handles large volumes of appointment requests while ensuring that critical patients receive immediate attention without manual sorting of the data [2][5].

6.2.2. Interval Scheduling (Prevent Overlapping Appointments)

To avoid double-booking of doctors, an interval scheduling strategy is implemented where each appointment is treated as a time interval with a start and end time. Before confirming a new booking, the system checks for overlaps with existing intervals for the selected doctor [2]. By using a greedy scheduling approach, the system ensures maximum non-overlapping appointments can be scheduled efficiently, maintaining proper time management and avoiding conflicts in doctors' schedules [2][5].

6.2.3. Search and Filter (Efficient Doctor Lookup)

For fast and user-friendly doctor discovery, optimized search and filtering techniques allow users to find doctors based on specialization, location, availability, and ratings [2][5]. This is achieved using efficient data structures and querying methods, such as indexed database searches or hashmap-based filtering, reducing search time complexity and improving performance. As a result, users can quickly find relevant doctors even when the database contains a large number of records [5][6].

6.2.4. Security Features

- Role-based authentication: The system incorporates role-based authentication to ensure secure access for different users, such as doctors and patients, allowing only authorized individuals to access specific functionalities and sensitive healthcare information [1][9].

7. Results And Discussion

The system was tested for appointment booking and scheduling, video consultation functionality, AI-based diagnosis suggestions, and multilingual input handling [1][2][7]. Results show that the system successfully reduces manual workload, improves communication across languages, and provides real-time healthcare support [1][4][6][8].As shown in Figure 2 View of a Patient Dashboard, Figure 3 View of a Patient Dashboard of available doctors, Figure 4 Video Consultation between doctor and patient.

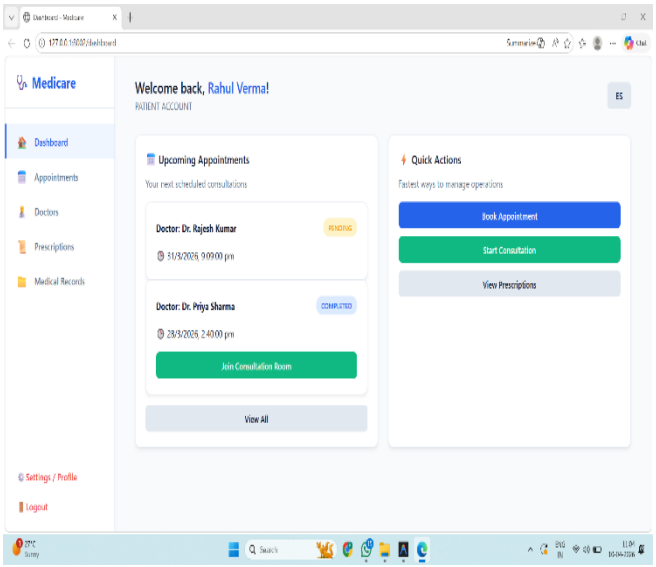

Figure 2 View of a Patient Dashboard

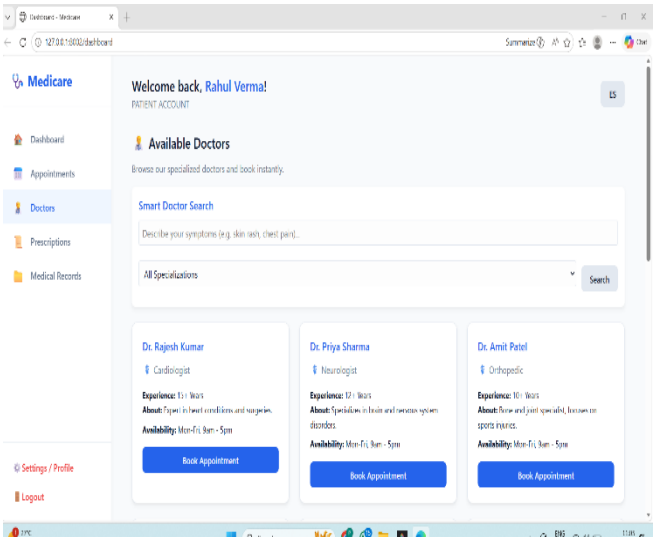

Figure 3 View of a Patient Dashboard of available doctors

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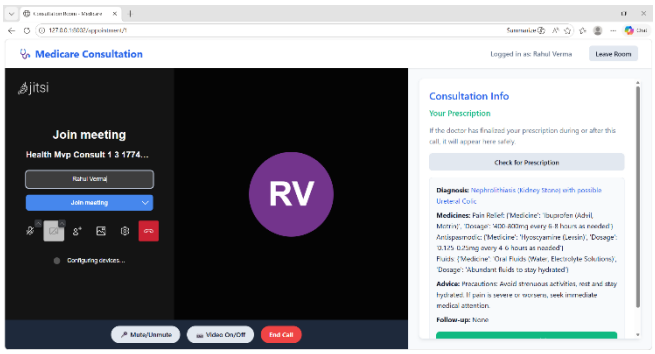

Figure 4 Video Consultation between doctor and patient

Conclusion

This paper presents E-Medicare, a smart healthcare system integrating artificial intelligence, multilingual support, and real-time communication [1][7][8]. The platform enhances accessibility, improves efficiency, and bridges communication gaps in healthcare services [4][6][8]. Future work may include training custom machine learning models and improving AI accuracy for diagnosis [7].

Acknowledgment

We would like to express our sincere gratitude to our institution and faculty members for their continuous support, valuable guidance, and encouragement throughout the completion of this project. Their assistance and insights greatly contributed to the successful development of this work.

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