

Smart Doctor Finder and Queue Tracker: An AI-Assisted Real-Time Healthcare Access and Queue Management System

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Abstract

Patients visiting hospitals often struggle to find suitable doctors, check their availability, and estimate waiting times. Many patients arrive at hospitals unaware if their chosen doctor is available, and they frequently encounter long queues without clear information about their place in line. The Smart Doctor Finder and Queue Tracker is a web-based healthcare application that aims to solve these issues by allowing users to search for doctors by specialization and location, check their availability, and track their position in the queue. The AI assistance feature examines the user's symptoms and suggests appropriate doctors based on their specialization and availability, offering available time slots for consultations. The application uses HTML5 and CSS3 for the front end, Python Flask for the back end, and MongoDB for the database. The queue tracking module keeps patients updated about their queue status, while the notification module sends reminders about appointments and queue positions. An evaluation of the application shows it successfully enables doctor searches, AI-assisted recommendations based on specialization, availability, and effective queue tracking and notifications. This project fills a research gap by providing a solution that blends intelligent doctor searches, availability information, and real-time queue tracking on a single healthcare platform to enhance accessibility and reduce wait times for patients.

Key Words — Artificial Intelligence, Doctor Recommendation, Healthcare Management, Real-Time Queue Tracking, Doctor Search, Waiting Time Reduction,

Hospital Management, Flask, MongoDB, Digital Healthcare.

I. INTRODUCTION

Healthcare management involves manual processes which are time-consuming and creates long queues resulting in patients not being able to easily find available doctors. Previous works have proposed smart hospital appointment systems and queue waiting-time prediction models based on historical data and patient arrival information to minimize waiting time and increase hospital operational efficiency [1],[5]. Upon visiting the hospital, the patient faces multiple challenges including the inability to identify which doctors are available and having no information on the waiting list progress. Studies on hospital queues have revealed that long waiting hours are the main cause of queues and proposed the adoption of digital healthcare technologies to resolve the patient flow problem [3],[7]. These challenges hinder the smooth flow of patient traffic creating disruptions in healthcare services delivery and negatively impacting optimal healthcare resource utilization especially in emergency situations where fast response is required.

Smart Doctor Finder and Queue Tracker is a web application healthcare system designed to address the challenges faced by patients when searching for doctors, checking doctor availability, and managing hospital queues. The proposed system is designed to allow patients to search for doctors based on their specialism and location, check doctor availability, and monitor the queue progress. Smart queue systems have been proposed based on digital tokens, artificial intelligence (AI), and machine learning (ML) technologies, IoT, and patient alerts to

enhance hospital services by managing the waiting lists [4],[8]. Other studies have proposed the use of Markov-based queue models and blockchain technology for effective queue processing and patient information management [2],[6]. The proposed application will have an AI assistant that can help the patient by recommending doctors based on their specialism and availability while informing them of the available time slots for appointments. Therefore, this paper presents a healthcare application that will enable patients to search for doctors, check their availability, receive AI recommendations, and monitor the waiting queue.

II. LITERATURE SURVEY

The rapid development of digital technologies has prompted most healthcare organizations to adopt web-based hospital management systems to improve operational efficiency and the overall quality of patient care. Such systems include solutions for managing queues and doctor appointments to ensure reduced waiting time and optimized healthcare delivery. Thus, a number of related works have been reviewed in order to identify key features to integrate into the proposed healthcare application. The following related works were identified through a literature search conducted for this paper. Deeksha M. Rames, Dhruthi E, Elina D., and Farman Ul Haq [1] have designed a “Smart Hospital Appointment System with Queue Waiting Time Predictor.” The proposed solution addresses the problem of long-waiting queues through an online appointment system and reducing the waiting time via machine learning algorithms that analyze past data and patient influx patterns. The authors emphasize the importance of a smart hospital appointment system that tracks and regulates patient influx and provides the required information to patients in a timely manner. Shadab Siddiqui, Shahin Fatima, Aleem Ali, Shashi Kant Gupta, Hemant Kumar Singh, and Seongki Kim [2] have proposed “Modeling of Queuing Systems Using Blockchain Based on Markov Process for Smart Healthcare Systems,” which addresses

the problem of prolonged waiting times by implementing a Markovian queueing model using a blockchain to ensure data privacy and security. The article demonstrates how the reduced waiting time can be achieved using Markov chains and Markovian batch-service queues in smart healthcare systems. Ajibike O. Itegboje and Yekini N. Asafe [3] have conducted a systematic review entitled “A Systematic Review of Queue Management System: A Case of Prolonged Wait Times in Hospital Emergency Rooms” to explore possible ways to address prolonged waiting times in hospital emergency rooms. In particular, the authors highlight the complexity of the concept of prolonged waiting times and discuss the insights on queue management systems, as well as the role of medical informatics and electronic medical records in modern healthcare. S. Gunasegaram, B. Gowtham, K. Gowdham, B. C. Gopish, and B. Elamathi [4] have developed a “Smart Queue Management” healthcare application, which uses Java programming language in combination with AI, machine learning, and IoT to offer digital token allocation, smart management of service requests, and interactive dashboards accompanied by SMS/email alerts to optimize the workflow and reduce waiting time. Based on the reviewed literature, the current research aims to develop an integrated healthcare application that will incorporate an advanced search engine for doctors, an appointment system, a queue management system, and provide assistance to patients in terms of information delivery. Unlike the solutions described in the related works, the proposed healthcare application will offer an integrated platform that will combine the functionality of hospital appointment systems, waiting time prediction, mathematical modeling of queues, management of waiting lists, and digital token allocation to improve healthcare delivery.

III. SYSTEM ARCHITECTURE

A. Overview

Smart Doctor Finder and Queue Tracker utilizes a modular web-based framework including frontend and backend modules. The frontend of the app was implemented in HTML5 and CSS3 and the Python Flask was used for backend implementation of the application. The suggested app employs MongoDB for the database part for saving doctor and patient information. The web application in healthcare comprises the following modules: User, Doctor Search, Availability, AI Assistance, Queue Management, Notification and Database modules. The subsequent sections will elaborate on the main modules of the suggested healthcare application.

B. AI Assistance

AI Assistance feature helps to understand the symptoms entered by the User and based on the specialization and availability suggests the Doctor by correlating the Medical Specialization and symptoms of the patient. The AI help feature provides the patient with some decision support but cannot provide professional medical advice, as it only suggests doctors based on the symptoms and the doctors availability. The subsequent subsection discusses the function of the real-time queue monitoring part.

C. Real-Time Queue Tracking

The Queue Monitoring component keeps track of where the patient is in the waiting line and supplies the current position of the patient. By offering this function patients are able to know their order in the line and the approximate waiting time without the patient having to directly ask for this information.

D. Database and Notification

The database part keeps records of both the patient and the doctor and keeps track of the doctor's availability appointments and queues. Through the notification module application can email/SMS notifications to the patient regarding appointment, availability and queue status. This part of the paper presents the methodology

followed in the development of the suggested healthcare application.

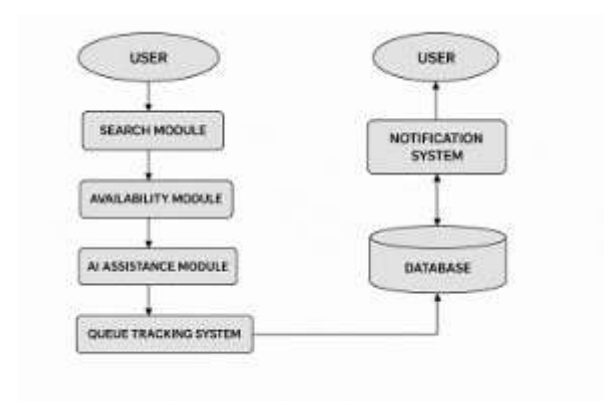


Fig.1 Block Diagram

IV. METHODOLOGY AND MODULE DESIGN

A. Doctor Search and Availability

Doctor Search component allows the user to search for a doctor by specialization and location. In addition, the availability component checks the availability of the doctor and offers the patient's the slots that are available to book. Doctor search and availability are essential features that enable the patients to find the right doctor without contacting or visiting various medical facilities to learn about their availability.

B. AI-Based Doctor Recommendation

AI Assistance component enables the user to enter their symptoms and get recommended doctors based on their specialization and availability. Doctor recommendation based on symptoms and availability is an innovative feature that supports patients in their quest to identify the best doctors to address their medical needs. The next section discusses the role of the queue tracking component in managing the flow of patients in a hospital.

C. Queue Management

The Queue Tracking module assists in managing the patient's waiting list and provides the patient with the information about their position in the queue. When visiting the clinic/hospital, every patient who arrives late

to the appointment or whose appointment has not started gets the information about the current state of the waiting list from the queue tracking component. The information provided by the queue tracking component is beneficial for the patient because it is updated, giving the current statistics of the waiting list to the patient. When the patients are being served from the waiting list, the queue tracking component updates the status, so the patient knows their exact position in the queue. The next component to be discussed is the Notification component.

D. Notification Management

The Notification component enables the healthcare application to notify patients about their appointments, availability, and queue status. The information provided by the notification component is valuable because it keeps the patients updated about their appointment status. Furthermore, the patients are notified about the waiting list status. The last component to be discussed is the User and Data component.

E. User and Data Management

The User component gives access to the healthcare application's features to the patient. The Database component stores doctor's and patient's data, doctor's availability, the appointment's details, and the waiting list's information. The section below will discuss the workflow of the proposed healthcare application.

F. System Workflow Description

In general, the workflow of Smart Doctor Finder and Queue Tracker starts with searching for the doctor based on availability and specialisation. After identifying the preferred doctor, the patient's symptoms are screened by the AI Assistance component to recommend an appropriate doctor. Then, the patient selects the preferred doctor, where the mentioned above queue tracking information is updated. Furthermore, the notification component provides the patient with the queue status information and reminds them of their appointment. The

described workflow represents the workflow of the proposed healthcare application, where doctor finder and queue tracker components are integrated to provide a patient-friendly experience.

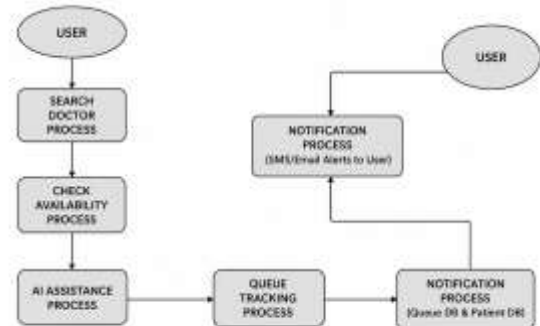


Fig.2 Data Flow Diagram

V. EXPERIMENTAL RESULTS AND ANALYSIS

A. Module-Level Functional Evaluation

The proposed healthcare application was evaluated based on the following modules/components: Doctor Search, Availability, AI Assistance, Queue Tracking, Notification, and Database. The Doctor Search component was found to perform its intended function of searching and providing information on doctors based on specialization and location. The Availability component, on the other hand, was observed to carry out its function of providing availability information on the doctors. The following subsection reports the evaluation results of the AI component.

B. AI Recommendation Evaluation

The AI Assistance component was found to perform its intended function of recommending doctors based on the symptoms entered by the patient and their availability by establishing a relationship between symptoms and medical specialties. The AI assistance feature enhances the recommendation of doctors based on symptoms and availability.

C. Queue Tracking Evaluation

The Queue Tracking component was found to carry out its function of providing the patient with their position in the queue and the queue statistics to provide the current status of the queue.

D. Notification Evaluation

The Notification component was found to provide the patient with the relevant information pertaining to their status and remind them of their appointments, thus facilitating communication between the healthcare application and the patient.

E. Overall System Evaluation

The overall evaluation of the healthcare application was based on the features and functions identified and described in this paper. The proposed healthcare application was observed to provide an end-to-end self-servicing platform for doctor search, availability, recommendation, and queue tracking and emailing/SMS notification to the patients.



Fig.3 Home Page



Fig.4 Doctor Search Interface



Fig.4 Queue Check Module



Fig.5 AI Symptom Checker Interface

VI. COMPARATIVE ANALYSIS

Smart Doctor Finder and Queue Tracker was compared against four related healthcare management approaches identified in the literature survey. The compared approaches include Smart Hospital Appointment System with Queue Waiting Time Predictor [1], Blockchain-Based Queuing System for Smart Healthcare [2], Queue Management System for Hospital Emergency Rooms [3], and Smart Queue Management [4]. The comparison criteria were developed based on the functions of the proposed healthcare application. The criteria include doctor search, doctor availability, AI

recommendation, appointment management, queue tracking, waiting time awareness, and patient notification. It was found that the proposed healthcare application was more integrated compared to the existing approaches as it covered doctor search, doctor availability, AI recommendation, appointment management, queue tracking, and patient notification. Smart Hospital Appointment System [1] was designed to manage appointments and patient flow in a hospital and provide real-time information on patient waiting time. The queuing system proposed by [2] was focused on leveraging blockchain technology to manage patient data, model queues using Markov chains, and reduce waiting time in hospitals. The systematic literature review [3] was focused on the factors contributing to long waiting time and how electronic medical records could be used to manage queues in hospitals. Finally, Smart Queue Management [4] was designed to improve patient flow in hospitals using digital tokens, dynamic service management, and dashboards. Unlike other approaches, Smart Doctor Finder and Queue Tracker was more integrated as it considered doctor search, availability, and recommendation, appointment management, queue tracking, and patient notification. The doctor search option was considered the key differentiating factor compared to the alternatives. Indeed, other comparable applications focused on managing the patient queue after patients arrived and selected their preferred doctor. By contrast, the proposed application allowed patients to search for doctors based on specialization, location, and availability to facilitate appointment scheduling. Furthermore, Smart Doctor Finder and Queue Tracker provided doctor availability and time information, thus enabling patients to make informed decisions when making appointments. Another unique feature of the proposed application is the use of AI assistance in recommending doctors based on symptoms and availability. While other comparable applications used machine learning algorithms in waiting time prediction,

the current study used AI assistance to recommend doctors based on symptoms and availability. The next unique feature of the proposed healthcare application is real-time patient queue tracking. Smart Doctor Finder and Queue Tracker allowed patients to track their position in the queue and received regular notifications regarding the queue status instead of asking for the queue status. Additionally, the proposed application was able to send email/SMS notifications to patients about their status, which was not available in other applications. Overall, the comparative analysis revealed that Smart Doctor Finder and Queue Tracker addressed the limitations of other approaches by integrating doctor search, availability, and AI recommendations while providing real-time queue tracking and patient notification.

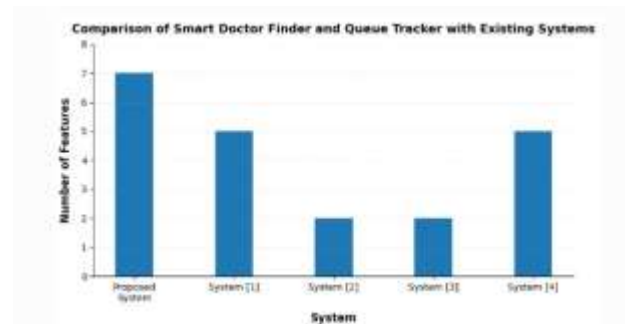


Fig.6 Comparison of Smart Doctor Finder and Queue Tracker with Existing Systems

VII. LEARNING OUTCOMES

This project on the Smart Doctor Finder and Queue Tracker allowed me to gain substantial experience in web development, including the frontend, backend, and database development using such programming languages as python-flask and mongoDB. It helped me learn how to create AI doctors that recommend doctors based on the patients' symptoms and availability. This project also gave me an insight into the real-time patient queue tracker and status monitoring system. Moreover, the project improved my research abilities by helping me identify the research question and the healthcare issue related to the topic. It also allowed me to enhance my understanding of

the design process of the whole system, including users, the database, AI, queue, notifications, etc. All in all, this project offered me a possibility to gain experience in developing a complex digital healthcare solution while focusing on responsible and sustainable healthcare practices.

VIII. FUTURE SCOPE

The future scope of the platform is related to the development of a healthcare platform, which would provide smart healthcare services to the users. The application can be equipped with additional functions such as a mobile app, online video consultation, and advanced artificial intelligence (AI) for doctor recommendations. Moreover, the platform can offer the option for choosing the preferred language and be used with wearable devices to collect patient data. The application can also estimate the queue time with high accuracy and equip with powerful hospital analytics to observe patients' flow and doctors' availability. In the future, the application can suggest doctors from different hospitals to attract more patients.

IX. CONCLUSION

The healthcare platform is a great idea because it offers a streamlined process for locating doctors and managing queues. It has positive implications for patients seeking reliable healthcare by shortening the waiting time and providing an enhanced experience. The utilization of artificial intelligence and real-time data makes finding the right doctor and tracking the queue easier. Other features such as applications, video consultations, languages, and wearable devices can be integrated to add value to the platform. In general, the healthcare platform could make the system more convenient and reliable.

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- [4] S. Gunasegaram, B. Gowtham, K. Gowdham, B. C. Gopish, and B. Elamathi, "Smart Queue Management" Advanced International Journal for Research (AIJFR).

This paper gave a detailed account of developing a smart queue management system that would reduce waiting times for patients in hospitals. It made use of a java backend system alongside digital tokens, AI, ML, and IoT to regulate the services provided. This was done by developing an interactive dashboard for the hospital staff and sending out notification updates via emails or SMS to patients.

[5] Deeksha M. Rames, Dhruthi E, Elina D., and Farman Ul Haq, “Smart Hospital Appointment System with Queue Waiting Time Predictor”, study on online scheduling, real-time patient monitoring, historical-data-based waiting-time prediction, and patient notification for improving hospital appointment management.

[6] Shadab Siddiqui, Shahin Fatima, Aleem Ali, Shashi Kant Gupta, Hemant Kumar Singh, and Seongki Kim, “Modelling of Queuing Systems Using Blockchain Based on Markov Process for Smart Healthcare Systems”, study on Markov-chain-based healthcare queue modelling, Markovian batch-service systems, blockchain-based patient-data security, and efficient queue processing.

[7] Ajibike O. Itegboje and Yekini N. Asafe, “A Systematic Review of Queue Management System: A Case of Prolonged Wait Times in Hospital Emergency Rooms”, systematic review focusing on prolonged emergency-room waiting times, queue-management approaches, medical informatics, and electronic medical records.

[8] S. Gunasegaram, B. Gowtham, K. Gowdham, B. C. Gopish, and B. Elamathi, “Smart Queue Management”, study on digital token allocation, AI/ML/IoT-supported dynamic service management, patient notifications, and interactive hospital dashboards.