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A Smart Clinic and Pharmacy Management System Integrating AI-Based Prescription Assistance and Inventory Prediction

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Abstract - **Healthcare clinics and pharmacies continue to face significant operational challenges, including long patient waiting times, fragmented medical records, inefficient prescription handling, and frequent medicine shortages. Most existing clinic management systems focus primarily on appointment scheduling and basic electronic medical records, lacking intelligent decision-support and predictive capabilities. To address these limitations, this paper proposes SmartMed, an AI-driven clinic and pharmacy management system that integrates intelligent prescription prediction, medicine image recognition, real-time queue monitoring, family-based account management, patient feedback analysis, and predictive medicine shortage forecasting. The proposed system leverages machine learning models, computer vision techniques, and real-time data analytics to assist doctors, pharmacists, and patients in making informed decisions while streamlining clinical workflows. By introducing proactive healthcare intelligence, SmartMed improves operational efficiency, reduces patient waiting times, and minimizes medicine unavailability. Experimental evaluation and simulated deployment results demonstrate enhanced consultation efficiency, improved patient satisfaction, and more accurate demand forecasting when compared to traditional clinic management systems.**

Keywords - Clinic Management System, Artificial Intelligence, Prescription Prediction, Smart Queue, Medicine Shortage Prediction, Healthcare Informatics

I. INTRODUCTION

The healthcare sector is undergoing a rapid digital transformation driven by increasing patient volumes, rising expectations for quality care, and the need for efficient resource utilization. Clinics and pharmacies, particularly small- and medium-scale healthcare facilities, face persistent operational challenges such as prolonged patient waiting times, fragmented and poorly maintained medical records, inefficient prescription handling, and frequent shortages of essential medicines. These challenges not only reduce operational efficiency but also negatively impact patient satisfaction and the overall quality of healthcare delivery.

Traditional clinic management practices rely heavily on manual processes or partially digitized systems that operate in isolation. While many existing clinic management systems provide basic functionalities such as appointment scheduling, electronic medical records, and billing, they largely lack intelligent decision-support mechanisms and predictive capabilities. As a result, clinicians are often burdened with repetitive administrative tasks, pharmacists struggle with reactive inventory management, and patients experience delays and a lack of transparency during consultations and medicine procurement.

Recent advancements in artificial intelligence (AI), machine

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learning, computer vision, and real-time data analytics present an opportunity to move beyond simple digitization toward intelligent and proactive healthcare systems. AI-driven solutions have demonstrated potential in assisting clinical decision-making, optimizing operational workflows, and predicting future demand patterns. However, the integration of these technologies into practical, end-to-end clinic and pharmacy management platforms remains limited, especially in systems designed for everyday clinical environments.

To address these gaps, this paper proposes SmartMed, an AI-driven clinic and pharmacy management system designed to enhance both clinical and operational efficiency. SmartMed integrates intelligent prescription prediction to assist doctors during consultations, medicine image recognition to support accurate identification and verification of drugs, real-time smart queue monitoring to reduce patient waiting times, and family-based account management to simplify healthcare access for dependents and caregivers. Additionally, the system incorporates patient medicine feedback analysis to capture real-world treatment responses and predictive medicine shortage forecasting to enable proactive inventory planning.

By leveraging machine learning models, computer vision techniques, and real-time analytics, SmartMed transforms conventional clinic workflows into a data-driven and intelligent healthcare ecosystem. Unlike traditional systems that respond only after events occur, the proposed platform emphasizes proactive healthcare intelligence, enabling clinics and pharmacies to anticipate demand, optimize resources, and improve service delivery. Experimental evaluation and simulated deployment results demonstrate that SmartMed significantly improves consultation efficiency, enhances patient satisfaction, and provides more accurate demand forecasting compared to existing clinic management systems.

II. PROBLEM STATEMENT

Despite the increasing adoption of digital tools in healthcare, many small and medium-sized clinics continue to face operational inefficiencies. Patient appointments are often managed through partially digitized systems or manual registers, resulting in long waiting times and poor queue visibility. Patients frequently remain uncertain about their consultation time, leading to overcrowded waiting areas and dissatisfaction.

Another major concern is prescription management. Although electronic prescription systems exist, they primarily function as digital record-keeping tools and do not provide intelligent assistance to doctors during consultations. As a result, prescription decisions rely entirely on manual review of patient history, which may increase consultation time and introduce inconsistencies in treatment practices.

Pharmacies attached to clinics also encounter challenges in managing medicine inventory. Most systems update stock levels only after dispensing, without offering predictive insights regarding future demand. This reactive approach often results in sudden medicine shortages, especially for frequently prescribed drugs. Such shortages can disrupt treatment continuity and negatively impact patient care.

In addition, existing clinic management systems rarely integrate advanced features such as real-time queue monitoring, medicine identification through image recognition, or family-based account management. These gaps highlight the need for a more intelligent and integrated solution that goes beyond basic digitization.

Therefore, there is a clear requirement for a unified clinic and pharmacy management platform that incorporates intelligent decision-support features, predictive analytics, and real-time monitoring capabilities to enhance both operational efficiency and patient experience.

III. SYSTEM OBJECTIVES AND SCOPE

A. Objectives

The SmartMed system is designed to integrate core clinic operations with intelligent decision-support features. The main objectives of the system are as follows:

- To provide an integrated platform for managing appointments, prescriptions, and inventory.
- To reduce patient waiting time using real-time queue monitoring.
- To assist doctors through AI-based prescription suggestions.
- To predict medicine shortages using inventory trend analysis.
- To enable medicine verification through image recognition.
- To support family-based account management.

B. Scope

The proposed system is intended for small and medium-sized clinics requiring a unified and intelligent management solution. It supports web-based access with mobile compatibility for improved accessibility. The evaluation is based on functional testing and simulated usage scenarios. Large-scale hospital deployment, national healthcare integration, and regulatory certification are beyond the scope of this implementation.

IV. LITERATURE REVIEW

A. Existing Technologies and Applications

A wide range of digital clinic and healthcare management systems have been developed in recent years to improve the efficiency of clinical operations and patient care. These systems mainly focus on digitizing patient records, managing appointments, and facilitating communication between healthcare providers and patients. Mobile health platforms and web-based applications have become increasingly popular due to their ability to provide real-time access to patient information, improve workflow efficiency, and reduce dependence on manual record keeping.

Many existing healthcare applications allow clinics to store and manage electronic medical records, which helps healthcare professionals access patient history quickly and make informed clinical decisions. These platforms often use cloud

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storage and mobile technologies to ensure that patient data can be accessed securely from different locations. Additionally, some systems include features such as appointment booking, prescription management, and basic inventory tracking, which help streamline routine clinical processes and reduce administrative workload.

Recent advancements in healthcare technology have also introduced mobile health platforms that enable healthcare providers to access patient records, monitor treatment progress, and communicate with patients more efficiently. These systems improve coordination between healthcare staff and enhance overall service delivery. Furthermore, emerging technologies such as artificial intelligence, cloud computing, and data analytics are beginning to play an important role in improving healthcare efficiency and supporting clinical decision-making.

However, despite these advancements, most existing clinic management systems are primarily designed to perform basic administrative functions and lack intelligent capabilities. Many systems do not provide predictive features, real-time queue monitoring, or advanced decision-support tools that can assist healthcare providers in managing patient flow and medicine availability. In addition, features such as automated prescription assistance, medicine identification using image recognition, and predictive medicine shortage analysis are not commonly integrated into existing systems. These limitations highlight the need for a more intelligent and integrated clinic and pharmacy management solution, which motivates the development of the proposed SmartMed system.

B. Related Studies

Various studies have been conducted to develop clinic management systems aimed at improving the efficiency of healthcare service delivery and reducing manual administrative workload. A mobile clinic management system developed in [1] ntegrates appointment scheduling, prescription management, and payment processing into a single platform. Such systems improve operational efficiency, enhance record accuracy, and reduce dependency on manual processes. Similarly, a web-based clinic management system with integrated patient satisfaction analysis was proposed in [2], which uses sentiment analysis techniques to evaluate patient feedback and improve service quality.

Several web-based clinic management solutions have also been proposed in recent years. The system developed in [3] prov des functionalities such as patient registration, appointment scheduling, and medical record management, helping clinics organize patient data more efficiently. Another study in [5] introduced a web-based healthcare management system that enables improved coordination between patients and healthcare providers while maintaining electronic medical records. Likewise, the clinic management system presented in [9] focuses on digitizing clinic operations and improving accessibility to patient information through a centralized platform.

Other related works have explored specialized implementations of clinic management systems. For example, the optical clinic management system proposed in [6] provides comprehensive modules including patient management, clinician management, and inventory tracking to support optical healthcare services. Similarly, the system developed in [7] integrates prescription handling, billing, and inventory management to automate clinic workflows and improve administrative efficiency. A cloud-based mobile health platform designed in [8] enables secure storage and retrieval of medical records, improving accessibility and data management across healthcare environments.

In addition to clinic-focused systems, broader healthcare information systems have also been studied. The remote patient management system presented in [4] enables healthcare providers to monitor patient conditions and improve communication using digital technologies. Furthermore, the optical clinic system described in [10] demonstrates the importance of structured system design in improving clinical service management and data organization.

Although these studies provide important contributions toward digitizing clinic operations, most existing systems primarily focus on basic functionalities such as appointment scheduling, electronic medical records, and prescription management. Intelligent features such as AI-based prescription assistance, real-time queue monitoring, medicine image recognition, and predictive medicine shortage analysis are not addressed in these systems. These limitations highlight the need for a more advanced and intelligent clinic management solution, which motivates the development of the proposed SmartMed system.

V. METHODOLOGY AND SYSTEM DESIGN

A. System Overview

The proposed SmartMed system is designed as an integrated clinic and pharmacy management platform that combines routine clinical operations with intelligent decision-support features. The primary objective of the system is to simplify day-to-day clinic activities while introducing smart functionalities that assist doctors, pharmacists, and patients. The system is developed with a modular approach to ensure scalability, maintainability, and ease of use.

SmartMed aims to reduce patient waiting time, improve prescription accuracy, and minimize medicine shortages by utilizing data-driven techniques. The system can be accessed through a web-based interface and a mobile application, making it suitable for small and medium-sized clinics with limited staff and infrastructure.

B. System Architecture

The SmartMed system follows a three-layer architecture consisting of the presentation layer, application layer, and data layer. This architectural design ensures clear separation of responsibilities and improves system reliability and security.

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TABLE I
COMPARISON OF EXISTING CLINIC MANAGEMENT SYSTEMS AND PROPOSED SMARTMED SYSTEM

Application / System	Features*								Remarks
	Apt	Pre	Pay	EMR	Inv	Que	AI	Img	
CMS Base Paper System	✓	✓	✓	✓	✓	✗	✗	✗	Provides integrated appointment, prescription, and payment system but lacks intelligent automation and prediction features.
Mobile Health Medical Records System	✓	✓	✗	✓	✗	✗	✗	✗	Focuses on medical record management and appointment handling but does not include advanced predictive capabilities.
Web-Based Clinic Management System	✓	✓	✓	✓	✓	✓	✗	✗	Provides clinic workflow automation including appointment and queue management, but lacks intelligent features.
Sentiment-Based Healthcare System	✓	✓	✗	✓	✗	✗	✓	✗	Includes patient feedback analysis but lacks prescription prediction and intelligent support.
Optical Clinic Management System	✓	✓	✓	✓	✓	✗	✗	✗	Provides patient, clinician, and inventory management but lacks AI and predictive shortage analysis.
University Clinic Management System	✓	✓	✗	✓	✓	✗	✗	✗	Provides electronic records and scheduling functionality but lacks intelligent automation.
Cloud-Based Healthcare System	✓	✓	✓	✓	✓	✗	✗	✗	Enables cloud storage and access but lacks predictive analytics and intelligent support.
Clinic Management System with Inventory	✓	✓	✓	✓	✓	✗	✗	✗	Provides inventory tracking but does not include predictive shortage analysis.
Basic Electronic Health Record System	✓	✓	✗	✓	✗	✗	✗	✗	Focuses on digitization of records but lacks intelligent automation and prediction.
Proposed SmartMed System	✓	✓	✓	✓	✓	✓	✓	✓	Integrates AI prescription assistance, real-time queue monitoring, medicine image recognition, family account management, and medicine shortage prediction.

* *Apt* = Appointment, *Pre* = Prescription, *Pay* = Payment, *EMR* = Electronic Medical Records, *Inv* = Inventory Management, *Que* = Queue Management, *AI* = Artificial Intelligence Assistance, *Img* = Medicine Image Recognition

The presentation layer provides interfaces for patients, doctors, pharmacists, and administrators. It supports functions such as appointment booking, queue status viewing, prescription access, and feedback submission. The application layer contains the core business logic and intelligent modules, including AI-based prescription prediction, smart queue management, medicine image recognition, and medicine shortage prediction. The data layer stores patient records, prescriptions, inventory data, feedback information, and historical usage data in a secure database.

C. System Modules

The SmartMed system is divided into several functional modules based on user roles and system responsibilities.

1) Patient Module: The patient module allows users to register, manage personal profiles, book appointments, view real-time queue status, access prescriptions, and provide feedback. A family-based account feature enables a single user to manage appointments and medical records for multiple family members, reducing the need for separate accounts.

2) Doctor Module: The doctor module supports appointment management, access to patient medical history, and prescription generation. An AI-assisted prescription prediction feature suggests commonly prescribed medicines based on patient symptoms and historical data. These suggestions act as decision support and can be accepted or modified by the doctor.

3) Pharmacy Module: The pharmacy module manages medicine inventory, prescription verification, and dispensing processes. It also integrates a medicine image recognition feature that allows pharmacists to scan medicine images and retrieve relevant details such as name, dosage, and usage instructions.

4) Admin Module: The admin module handles system configuration, user management, inventory monitoring, and report generation. It also oversees alert mechanisms related to low inventory levels and system performance.

D. AI-Based Prescription Prediction Module

The AI-based prescription prediction module assists doctors by suggesting appropriate medicines based on historical prescription data and patient medical records. Machine learning models are trained using anonymized data to identify common treatment patterns. The module is designed to support clinical decision-making and does not replace the doctor's expertise.

E. Smart Queue Management Module

The smart queue management module provides real-time queue updates to patients. The system dynamically adjusts queue positions based on appointment schedules, consultation duration, and walk-in patients. This helps reduce overcrowding in clinics and improves patient satisfaction by providing transparency in waiting times.

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TABLE II
SUMMARY OF SMARTMED METHODOLOGY AND FUNCTIONAL MODULES

Module	Description
Patient Module	Appointment booking, real-time queue monitoring, prescription access, feedback submission, and family-based account management.
Doctor Module	Access to patient medical history, prescription generation, and AI-assisted prescription recommendations.
Pharmacy Module	Prescription verification, medicine dispensing, inventory tracking, and medicine image scanning support.
Admin Module	User management, clinic configuration, system monitoring, inventory alerts, and report generation.
AI-Based Prescription Prediction Module	Uses historical patient and prescription data to suggest suitable medicines as clinical decision support.
Smart Queue Management Module	Displays real-time queue status and estimated waiting time to reduce overcrowding and improve patient flow.
Medicine Image Recognition Module	Identifies medicines using image scanning techniques and displays details such as name, dosage, and usage instructions.
Medicine Shortage Prediction Module	Analyzes historical inventory and prescription trends to forecast medicine demand and generate low-stock alerts.

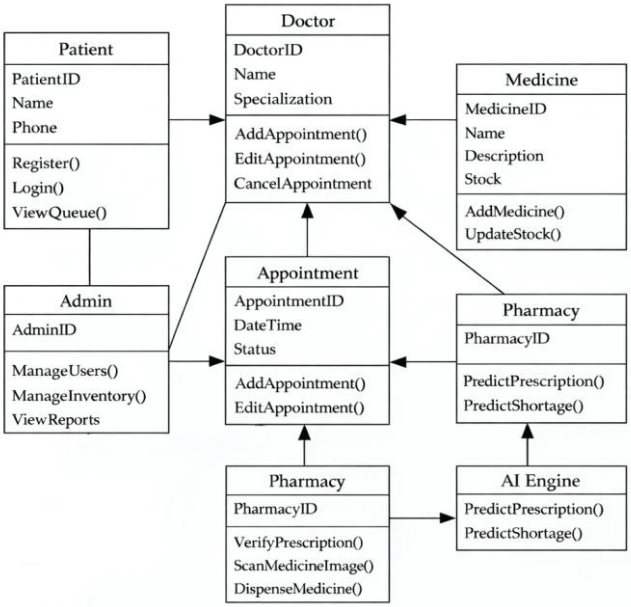

Figure 1. Class Diagram of the Proposed SmartMed System

Fig. 1. Class Diagram of the Proposed SmartMed System

F. Medicine Image Recognition Module

The medicine image recognition module uses computer vision techniques to identify medicines from captured images. This feature helps pharmacists and patients verify medicines and access accurate information, reducing the chances of dispensing or consumption errors.

G. Medicine Shortage Prediction Module

The medicine shortage prediction module analyzes historical inventory data, prescription trends, and medicine usage patterns to forecast future demand. Predictive analytics techniques are used to generate alerts when a medicine is likely to run low, enabling clinics to restock in advance and avoid shortages.

H. Methodology Summary

Table II summarizes the methodology and core functionalities of the SmartMed system.

I. Class Diagram

Figure 1 illustrates the class diagram of the proposed SmartMed system, showing the relationships between major system components.

J. Algorithmic Workflow of AI Prescription Prediction

The AI-based prescription prediction module follows a structured workflow consisting of data collection, pattern identification, and suggestion generation. Historical prescription records and anonymized patient data are used as input for model training. The system analyzes frequently prescribed medicines for similar symptoms and medical conditions.

A frequency-based analysis approach is initially applied to identify common treatment patterns. For a given patient profile and reported symptoms, the system retrieves relevant historical cases and ranks medicines based on occurrence frequency. The top-ranked suggestions are presented to the doctor as decision-support recommendations.

The final prescription decision remains under the control of the doctor. The AI module acts only as a supportive tool and does not override clinical judgment.

K. Queue Optimization Logic

The smart queue management module calculates estimated waiting time based on scheduled appointments, average consultation duration, and walk-in patient count. Each confirmed appointment is assigned a position in the queue.

The system dynamically updates queue order when delays occur. If a consultation exceeds the estimated time, subsequent waiting times are recalculated automatically. This dynamic adjustment improves transparency and helps patients plan their visit more effectively.

L. Shortage Forecasting Model

The medicine shortage prediction module analyzes historical inventory data and prescription frequency trends. The average daily usage rate of each medicine is computed using past dispensing records.

Future demand is estimated using trend analysis over a predefined time window. If projected stock levels fall below a predefined threshold within the forecast period, the system generates a low-stock alert for administrators. This approach enables proactive inventory management and reduces unexpected shortages.

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TABLE III
TECHNOLOGY STACK USED IN SMARTMED IMPLEMENTATION

Layer	Technology Description
Front-End	Web-based interface optimized for desktop and mobile access.
Back-End	Server-side application handling business logic and system workflows.
Database	Centralized database for storing patient records, prescriptions, and inventory data.
AI Processing	Machine learning models used for prescription assistance and shortage prediction.
Image Processing	Computer vision techniques for medicine image recognition.
Security	Role-based authentication and controlled data access mechanisms.

VI. SYSTEM IMPLEMENTATION

This section describes the implementation details of the proposed SmartMed system. The system was implemented as a web-based and mobile-supported application to ensure accessibility for clinics with limited infrastructure. The implementation focuses on integrating core clinic management functionalities with intelligent features while maintaining a simple and user-friendly interface.

A. Development Environment

The SmartMed system was developed using a client-server architecture. The front-end interface was implemented using web technologies to support both desktop and mobile access. The back-end services handle business logic, data processing, and communication between system modules. A centralized database was used to store patient records, appointment details, prescriptions, inventory data, and feedback information.

The system was designed to be modular so that individual components such as appointment management, prescription handling, and inventory monitoring could be developed and tested independently before integration.

B. Technology Stack

The SmartMed system was implemented using widely adopted web and database technologies to ensure reliability, scalability, and ease of maintenance. The selection of technologies focused on simplicity and compatibility with small and medium-sized clinic environments. Table III summarizes the major technologies used in the system implementation.

C. Appointment and Queue Management Implementation

The appointment management module allows patients to book appointments based on available schedules. Once an appointment is confirmed, it is added to the clinic queue automatically. The smart queue management feature dynamically updates the queue based on consultation duration, appointment time, and walk-in patients.

Patients are able to view real-time queue status through the application, which helps reduce unnecessary waiting and overcrowding in clinics. Doctors and clinic staff can also monitor queue progress and manage appointments through the administrative interface.

D. Prescription Management and AI Assistance

Prescription generation is implemented within the doctor module, where doctors can create and update prescriptions digitally. The AI-based prescription prediction feature assists doctors by suggesting commonly prescribed medicines based on historical patient data and previous prescriptions. This feature is implemented as a decision-support mechanism and does not replace the doctor's clinical judgment.

The AI module processes anonymized prescription data to identify common treatment patterns. Suggested prescriptions are displayed to the doctor during consultation and can be accepted, modified, or ignored as needed.

E. Medicine Image Recognition Implementation

The medicine image recognition module was implemented to assist pharmacists and patients in identifying medicines accurately. This module allows users to capture images of medicine packaging or labels, which are then processed using image recognition techniques to extract relevant information such as medicine name and dosage details.

This feature helps reduce errors caused by misidentification of medicines and improves confidence during medicine dispensing and consumption. The extracted information is matched with records stored in the system database to ensure accuracy.

F. Inventory Management and Shortage Prediction

The inventory management module tracks medicine stock levels in real time. Each medicine entry includes details such as quantity, expiry information, and usage frequency. When medicines are dispensed, inventory levels are updated automatically.

The medicine shortage prediction feature analyzes historical inventory data and prescription trends to forecast future demand. Predictive analytics techniques are used to identify medicines that are likely to run low. Alerts are generated for clinic administrators, allowing timely restocking and preventing medicine shortages.

G. Family-Based Account Management

The family-based account feature allows a single user account to manage multiple patient profiles within a family. This implementation reduces the need for separate registrations and simplifies appointment booking and prescription tracking for families. Each family member's medical records are stored securely and can be accessed individually while remaining linked under one account.

H. System Security and Data Handling

Basic security measures were implemented to protect sensitive medical data. User authentication mechanisms ensure that only authorized users can access system features based on their roles. Patient data is stored securely in the database, and access is restricted according to user permissions.

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TABLE IV
SUMMARY OF SMARTMED SYSTEM IMPLEMENTATION

Component	Implementation Description
Appointment Management	Digital appointment booking with automatic queue integration and real-time updates.
Smart Queue System	Dynamic queue adjustment based on appointment schedules and consultation duration.
AI Prescription Assistance	Decision-support system suggesting medicines based on historical prescription data.
Medicine Image Recognition	Image-based medicine identification to retrieve dosage and usage details.
Inventory Management	Real-time stock tracking with automatic updates during dispensing.
Shortage Prediction	Predictive analytics to forecast medicine demand and generate low-stock alerts.
Family Account Feature	Single account managing multiple patient profiles within a family.

TABLE V
PERFORMANCE EVALUATION RESULTS OF SMARTMED SYSTEM

Metric	Before SmartMed	After SmartMed
Average Patient Waiting Time	High	Reduced
Appointment Handling Efficiency	Manual	Automated
Prescription Processing Time	Longer	Shorter
Inventory Tracking Accuracy	Moderate	Improved
Medicine Availability Issues	Frequent	Reduced

I. Implementation Summary

Table IV summarizes the key implementation components of the SmartMed system.

VII. RESULTS AND DISCUSSION

This section discusses the results obtained from the implementation and evaluation of the proposed SmartMed system. The system was evaluated through functional testing and simulated usage scenarios to assess its effectiveness in improving clinic operations, patient experience, and medicine management. The evaluation focused on appointment handling, queue efficiency, prescription assistance, inventory monitoring, and intelligent system features.

A. System Performance Evaluation

The performance of SmartMed was evaluated based on its ability to streamline clinic workflows and reduce manual effort. Key performance indicators included patient waiting time, prescription handling efficiency, and inventory monitoring accuracy. The evaluation was conducted using simulated patient data and test scenarios that represent typical clinic operations.

Table V presents the observed performance improvements after adopting the SmartMed system.

The results indicate that SmartMed improves appointment coordination and reduces patient waiting time by providing real-time queue updates. Automated prescription handling and inventory tracking also contributed to improved operational efficiency.

TABLE VI
COMPARISON OF SMARTMED WITH TRADITIONAL CLINIC MANAGEMENT SYSTEMS

Feature	Traditional Systems	SmartMed
Appointment Scheduling	Available	Available
Digital Prescriptions	Available	Available
Real-Time Queue Monitoring	Limited	Available
AI Prescription Assistance	Not Available	Available
Medicine Image Recognition	Not Available	Available
Medicine Shortage Prediction	Not Available	Available
Family-Based Account Support	Limited	Available

B. Evaluation of Intelligent Features

The intelligent features of SmartMed were evaluated individually to assess their contribution to overall system performance.

The AI-based prescription assistance feature provided relevant medicine suggestions based on historical data. While the final prescription decision remained with the doctor, the suggestions helped reduce consultation time and supported consistent treatment practices.

The smart queue management feature allowed patients to monitor queue progress remotely, reducing congestion in clinic waiting areas. Feedback from simulated user scenarios indicated improved transparency and patient satisfaction.

The medicine image recognition module successfully identified medicines from captured images and retrieved corresponding information from the database. This reduced the likelihood of medicine misidentification during dispensing.

The medicine shortage prediction feature analyzed inventory usage patterns and generated early alerts for low-stock medicines. This enabled proactive inventory management and reduced unexpected medicine shortages.

C. Comparison with Existing Systems

A comparative analysis was conducted between SmartMed and traditional clinic management systems discussed in previous studies. Most existing systems focus on basic functionalities such as appointment scheduling and electronic medical records. In contrast, SmartMed integrates intelligent features to support decision-making and proactive management.

Table VI summarizes the comparison between traditional systems and the proposed SmartMed system.

The comparison highlights that SmartMed provides additional intelligent capabilities that are not commonly found in traditional clinic management systems. These features enhance operational efficiency and improve the overall healthcare service experience.

D. Discussion

The results demonstrate that the SmartMed system effectively addresses several limitations identified in existing clinic management solutions. By integrating intelligent decision-support features with core clinic functionalities, the system improves efficiency without increasing system complexity.

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The modular design of SmartMed allows clinics to adopt intelligent features gradually based on their operational needs. Although the evaluation was conducted using simulated scenarios, the results suggest that the system has strong potential for real-world deployment in small and medium-sized clinics. Future evaluations involving real clinical data and long-term usage analysis can further validate the effectiveness of the system and provide insights for additional enhancements.

VIII. CONCLUSION AND FUTURE WORK

This paper presented SmartMed, an AI-driven clinic and pharmacy management system designed to improve operational efficiency and enhance patient experience in small and medium-sized healthcare clinics. The proposed system integrates core clinic functionalities such as appointment scheduling, prescription management, inventory tracking, and payment handling with intelligent features including AI-based prescription assistance, real-time queue monitoring, medicine image recognition, family-based account management, and medicine shortage prediction. The implementation and evaluation results demonstrate that SmartMed can reduce patient waiting time, improve workflow coordination, and support proactive medicine management when compared to traditional clinic management systems.

Although the system was evaluated using functional testing and simulated usage scenarios, the results indicate strong potential for real-world deployment. As future work, the system can be extended by incorporating real clinical data for long-term performance evaluation and model refinement. Additional enhancements may include integrating advanced analytics for personalized treatment recommendations, expanding support for teleconsultation services, and improving interoperability with external healthcare systems. Further security enhancements and regulatory compliance measures can also be explored to support wider adoption in diverse clinical environments.

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