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A Survey Paper on Intelligent Pharmacy Management and Healthcare Integration

Mr.Raghavendrachar S[1], Divyashree S[2], Surabhi Rao[3], Himashwetha K G[4], D S Aishwarya[5]

Associate Professor, Dept of CSE, KSIT, Karnataka, India[1]

Student, Dept of CSE, KSIT, Karnataka, India[2-5]

Abstract: PharmAssist is a cloud-based Pharmacy Management System with artificial intelligence for better stock management in pharmacies, telemedical services for doctors and patients. Unlike offerings available in the market today, it has an AI-driven alternative medicine suggestion module that recommends alternatives by comparing medicine compositions.

The system also provides e-prescriptions, where doctors e-mail prescriptions to patients. It also provides real- time pharmacy stock management with low-stock and expiration date automatic reminders. Location search for pharmacies assists users in searching for pharmacies around them using Google Places API, displaying shop information.

PharmAssist is built with cloud infrastructure (AWS) and Flask, MongoDB Atlas, and artificial intelligence models (TensorFlow), thus enhancing efficiency, accessibility, and reliability in the digital pharmacy platform.

Keywords: Pharmacy Management System, Artificial Intelligence, Machine Learning, Telemedicine, Alternative Medicine Recommendations, Cloud Computing, E-Prescriptions, Stock Management, Healthcare Technology, Pharmacist-Patient- Doctor Integration, AI-Based Drug Substitution, MongoDB Atlas, AWS Lambda, Flask API, Google Places API, Video Consultation, Twilio API, UPI-Based Payments.

I. INTRODUCTION

With the always advancing healthcare landscape, digital technologies play a key role in streamlining processes and enhancing patient outcomes. PharmAssist is a Cloud-based, Artificial Intelligence (AI)-assisted Pharmacy Management and Telemedicine Platform that brings the patients, interaction with doctors' and pharmacists' onto a single platform, enabling smooth consultations and smart medication management. Leveraging the use of Artificial Intelligence (AI), Machine Learning (ML), and cloud technology, PharmAssist promises to revolutionize the practice of medical consultations, prescription management, and pharmacy management.

This project provides role-based web software through which doctors can conduct video consultations and generate e-prescriptions, patients can schedule appointments and get AI-based alternative medicine recommendations, and pharmacists can monitor medicine stocks and maintain stock availability. The admin module includes UPI-based payment, which facilitates seamless financial transactions within the platform. Adding ML-based alternative medicine recommendations makes patients more accessible, while monitoring inventory in real-time prevents stock shortages for pharmacists and ensures efficient expiry reminders.

The primary goals of PharmAssist are to increase telemedicine access, automate pharmacy stock management, and utilize AI- based intelligence to maximize healthcare outcomes. PharmAssist's secure authentication mechanism (JWT), video calls (Jitsi Meet API), geolocation-based pharmacy search (Google Maps API), and smart medicine recommendation system (Flask API with TensorFlow) provide a seamless user experience.

Through the convergence of cutting-edge technological innovation and the medical industry, PharmAssist seeks to create an intelligent, efficient, and easily accessible medical system that unites patients with doctors and pharmacists to promote pharmacy operations as well as patient care. The following sections will examine more deeply the nature, deployment, and real-world impacts of PharmAssist, showing how artificial intelligence and cloud computing can revolutionize modern healthcare solutions.

II. LITERATURE REVIEW

1) PharmaEasy / Apollo 24/7

PharmaEasy and Apollo 24/7 are popular portals offering online medicine ordering, doorstep delivery, doctor consultation (restricted to Apollo hospitals), and health checkup. Convenient as they are, these portals are more oriented towards medicine delivery than AI-driven decision support systems for patients and pharmacies. Their restricted doctor consultations and less sophisticated pharmacy stock management features set them apart from the proposed

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requirements.

PharmAssist is distinctive in combining AI-driven alternative medicine recommendations for patients and pharmacists such that they get appropriate alternatives when the prescribed drug is not available. PharmAssist also provides pharmacies with digitalized inventory management, which includes real-time monitoring of stocks, low- stock alerts, and expiry alerts. PharmAssist, unlike PharmaEasy and Apollo 24/7, brings patients, doctors, and pharmacies together on one platform, making the whole healthcare process convenient.

2) TrueMeds / Tata 1mg

TrueMeds is focused on low-cost medicine solutions that offer cost-effective options to patients, whereas Tata 1mg provides consultations from doctors and diagnostic centers alongside medicine delivery. Though both these websites are popular, their application of AI is mainly cost-oriented, and they do not offer real-time tracking of pharmacies' stock.

PharmAssist extends these features with AI-driven stock alerts for pharmacies, preventing medicine shortages and reducing expiry losses. Apart from this, it integrates video consultations with doctors, enabling seamless consultation to prescription generation. Unlike TrueMeds, PharmAssist's alternative medicine suggestions are AI-driven only to give better medicine alternatives.

3) Practo

Practo is a highly established doctor-booking and telemedicine portal where users can consult medical professionals and, in certain instances, can prescribe medicines. But it does not have AI-based pharmacy integration and stock management of medicines for pharmacists.

PharmAssist also features an AI-driven alternative medicine recommendation system for pharmacists and patients. It also features a module for inventory management of pharmacies with expiry reminder, auto-reorder reminders, and real-time tracking for pharmacists, which Practo does not currently have.

4) C-Square (Pharmacy ERP Solution)

C-Square is a business-focused pharmacy management software that is more interested in inventory management, billing solutions, and B2B pharmacy operations. It is more suited to wholesalers and retailers than end-users.

PharmAssist, however, integrates the proximity of local pharmacies, doctor consultations, and AI-based medication suggestions for patients. Additionally, PharmAssist integrates telemedicine capability with electronic prescriptions so that patients can receive digital prescriptions from doctors directly through email. This integrated synergy of AI-based suggestions, electronic prescriptions, and pharmacy stock management makes PharmAssist stand apart from traditional pharmacy ERP solutions like C- Square.

5) Traditional Pharmacy Administration Documentation (Manual Documentation)

Conventional pharmacy management systems heavily depend on manual recording and hence cause inefficiency, loss of information, and medication errors. Paper prescriptions are easily misplaced, and monitoring availability of medicine is troublesome. Additionally, pharmacies are unable to monitor stock level, expiration dates, and demand forecasting.

PharmAssist eliminates these constraints with automated medicine stock monitoring, providing real-time visibility into available medicines. Pharmacies get alerts for expired medicines and low stock, enabling them to manage inventory ahead of time. PharmAssist also uses AI-based insights to enable pharmacists to suggest substitute medicines, and hence, PharmAssist is a big leap ahead of traditional manual systems.

III. OBJECTIVES

1) Enhance Pharmacy Management Efficiency: The primary objective of this project is to enhance the efficiency of pharmacy management. PharmAssist aims to automate the monitoring of inventories, reduce wastage of medicines, and maximize stock management through real-time alerts and intelligence.
2) Provide AI-Based Alternative Medicine Recommendations: PharmAssist, applying AI technology, assists patients and pharmacists in determining suitable alternative medicines if a prescribed medication is out of stock. Unlike cost-based recommendations, the system takes into account medical equivalence and efficacy to ensure maximum

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patient health.

3) Bridges Patients to Doctors and Pharmacies: PharmAssist facilitates a connected health ecosystem by connecting patients to doctors and pharmacies under one umbrella. The integrated system enhances the patient experience in general.

IV. METHODOLOGY

PharmAssist is a cloud-integrated AI-driven Pharmacy Management Platform aimed at facilitating effective management of medicine, doctor consultation, and e-prescription generation. The approach is modular in nature, facilitating scalability and effectiveness in pharmacy stock and AI-driven alternative medicine suggestion.

A. System Architecture Role Based Acess

PharmAssist is a cloud-based role-based application, managing Patients, Doctors, and Pharmacists securely with certain functionalities.

1) User Authentication and Access Control:

a) It employs JWT-based authentication for validating user sessions.

b) Role-based access allows patients, physicians, and pharmacists to have distinct privileges.

2) Cloud & Deployment

a) Frontend: React.js (deployed on Netlify for fast UI rendering).

b) Backend: Node.js & Express.js (running on AWS EC2 for maximizing request processing).

c) Database: MongoDB Atlas (Cloud) to manage users, prescriptions, and inventory.

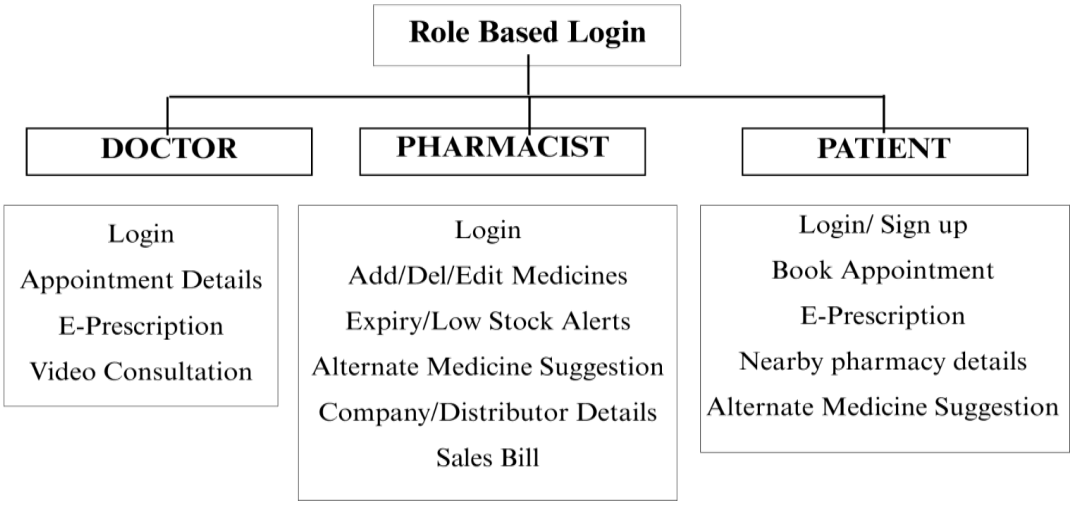

Fig : Block Diagram

B. AI-Powered Alternative Medicine Suggestion System

PharmAssist incorporates AI/ML models to recommend substitute medicines by active ingredient to facilitate smooth drug substitution.

1) Workflow:

a) Patients and pharmacists look for drugs, and the system proposes AI-driven alternatives.

b) The ML model compares the composition and recommends equally effective drugs.

2) Technology Stack and Deployment:

a) ML Model: Developed under TensorFlow.

b) API Integration: Flask API on AWS Lambda (offering low-latency medicine recommendations).

c) Frontend Integration: React.js makes requests to the AI API through REST.

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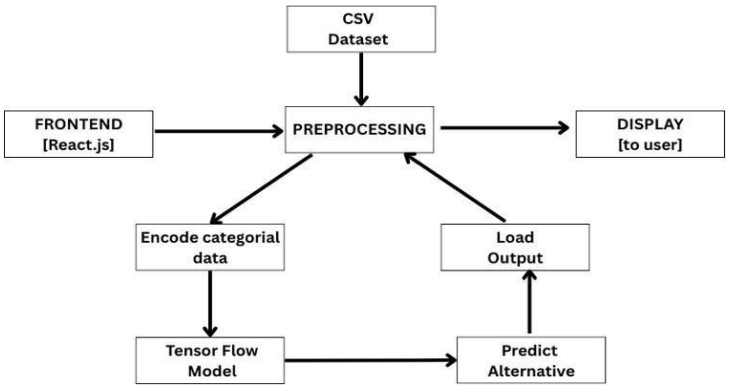

Fig : Architecture of ML model

C. Video Consultation Module

PharmAssist offers live virtual doctor consultations, expanding access to healthcare.

1) Workflow

a) Patients schedule appointments online with available physicians.

b) At the programmed time, the video consultation is conducted through an embedded API. The doctor generates an electronic prescription after consultation, which is emailed to the patient.

2) Tech Stack & API Integration

a) Video API: Twilio API (secure telemedicine calls).

b) Backend: Node.js using appointment scheduling with MongoDB Atlas.

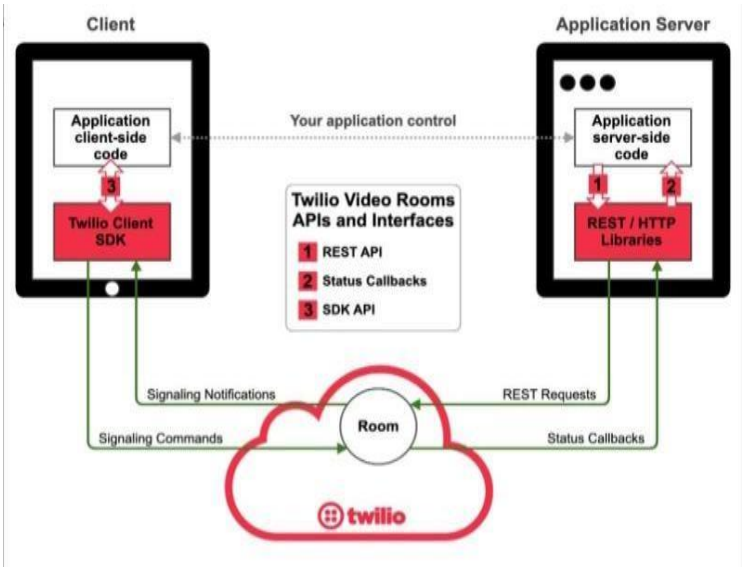

Fig : Architecture of Video Consultation https://www.twilio.com/docs/video/tutorials/understanding-video-rooms-apis

D. Pharmacy Management

The pharmacy inventory management system offers real-time tracking of inventories, expiration dates, and AI-based automated restocking recommendations.

1) Workflow:

a) Pharmacists can add, update, and monitor stock.

b) The system notifies pharmacists of low stock and upcoming expiration dates.

c) AI-driven alternative medicine recommendation.

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2) Technological Infrastructure and Cloud Integration:

a) Database: MongoDB Atlas (stores stock data).

b) AI Restocking Model: Flask API (deployed on AWS Lambda) for predicting stock.

c) Backend Alerts: Node.js (Node-Cron) for auto-stock notifications. Location-Based Pharmacy Search

1) Workflow

a) When you open the app, it asks to know the location.

b) If permission is allowed, the app gets the user's latitude & longitude with:

c) HTML5 Web Geolocation API.

d) The application retrieves the following pharmacies details by making a request to Google Places API based on the user's location.

i. Name of Pharmacy, Phone Number, Address.

ii. Distance from User's Location.

iii. Operating Hours .

iv. Tap to Call [the pharmacy].

v. Get Directions [with Google Maps].

2) Tech Stack & API Integration Location Access:

a) Web: HTML5 Geolocation API. Download Neighborhood Pharmacies:

b) Google Places API (to list pharmacies).

E. Cloud Deployment and Scalability

To guarantee both high availability and scalability, the system is implemented on cloud infrastructure that possesses auto-scaling features.

1) Deployment Strategy:

a) Frontend: Deployed on Netlify (serverless UI deployment).

b) Backend: Running on AWS EC2 (processes business logic & API requests).

c) Database: MongoDB Atlas (cloud-managed DB for scalability).

d) AI Services: Flask-built ML APIs deployed on AWS Lambda.

Through automation of stock monitoring, AI-driven alternative medicine suggestion, and doctor-patient communication, the platform bridges doctors and pharmacies with patients. Feature Cloud (AWS)/API Used/Deployment AI Medicine Recommendations.

Feature	Cloud (AWS)	API Used	Deployment
AI Medicine Suggestions	AWS Lambda (Flask API)	Flask REST API	AWS Lambda
Video Consultation	-	Twilio API	Node.js Backend
Pharmacy Inventory	MongoDB Atlas (Cloud)	Flask AI Model API	AWS Lambda
Web Frontend	AWS / Netlify	-	React.js (UI)
Backend Services	AWS EC2 / Render	Express.js APIs	Node.js Backend

V. CONCLUSION

Hassle-free transactions. By integrating existing technologies such as React.js, Node.js, artificial intelligence, and cloud computing, PharmAssist improves the traditional pharmacy infrastructure, addressing significant issues such as medicine shortages, expired products, and poor record-keeping. In addition to automating, the system also improves the overall pharmacy experience. PharmAssist is a differentiated, scalable, and innovative health product, optimizing pharmacy operations, enhancing doctor-patient interaction, and facilitating improved access to medicines through AI and cloud computing. PharmAssist is an end- to-end Pharmacy Management System. In contrast to current platforms, PharmAssist integrates video consultations, AI- based alternative medicine recommendations, and real-time stock management within a single ecosystem. The project ensures a streamlined e-prescription system, where doctors generate and send prescriptions directly to patients via email. Moreover, location-based pharmacy discovery allows

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patients to find nearby pharmacies instantly, enhancing accessibility. The AI-based alternative medicine recommendation system offers pharmacists and patients with effective alternatives of medicines, to ensure a more informed healthcare experience. PharmAssist utilizes a cloud-based architecture to achieve scalability. User data, medicine records, and transactions are efficiently managed by MongoDB Atlas, while high availability is ensured by AWS-based deployment. AI model on Flask processes suggestions for alternative medicines, facilitating improved decision- making on both patient and pharmacist ends. Payment through the UPI-based payment system also makes doctor consultation charges easier, safe.

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