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PharmaLink: Bridging Patients, Doctors, and Pharmacies

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

[1]Associate Professor, Computer Science and Engineering, K.S. Institute of Technology, Bengaluru, Karnataka, India.
[2,3,4,5]Student, Computer Science and Engineering, K.S. Institute of Technology, Bengaluru, Karnataka, India.

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Abstract: Healthcare systems often suffer from fragmentation between patient consultation, prescription generation, and pharm acy services, leading to inefficiencies and reduced accessibility. This paper presents PharmaLink, a web-based healthcare platform that integrates patients, doctors, and pharmacists into a unified ecosystem. The system enables patient registration, doctor appointment booking, teleconsultation via Google Meet, and automated e-prescription delivery through email. Pharmacists can manage inventory, track expiry dates, and receive low-stock alerts.

An unsupervised machine learning model based on TF-IDF and Cosine Similarity is used to recommend alternative medicines when required. Additionally, a pharmacy locator using Google Maps API enhances accessibility. The system follows a three-tier architecture (frontend, backend, database), ensuring scalability and performance. Experimental results demonstrate improved healthcare coordination, efficient inventory management, and real-time intelligent medicine recommendations.

Keywords: Telemedicine, Healthcare Platform, Flask, MySQL, Machine Learning, TF-IDF, Cosine Similarity, E-Prescription, Pharmacy Management.

INTRODUCTION

Access to efficient healthcare services remains a major challenge due to the lack of integration between consultation systems and pharmacy services. Patients often struggle to find doctors, book appointments, and obtain medicines seamlessly. Similarly, pharmacies face issues such as stock mismanagement, expired medicines, and lack of intelligent substitution mechanisms.

PharmaLink addresses these challenges by integrating patients, doctors, and pharmacists into a single digital platform. Patients can consult doctors online and receive prescriptions digitally, while pharmacists manage inventory and provide medicines efficiently. The inclusion of machine learning-based recommendations enhances the system's intelligence by suggesting alternative medicines when required.

MATERIALS AND METHODS

The PharmaLink platform was developed using modern web technologies to ensure scalability and efficiency. The frontend was built using HTML, CSS, JavaScript, and React.js to provide a responsive user interface. The backend was implemented using Python (Flask framework) along with API integration support. MySQL was used as the relational database to store user data, prescriptions, and inventory details.

The system follows a structured development methodology consisting of the following phases:

1. Requirement Analysis
The system identifies three main stakeholders: patients, doctors, and pharmacists. Functional requirements include appointment booking, teleconsultation, e-prescriptions, pharmacy inventory management, and medicine recommendation.

2. System Design
A three-tier architecture is used:
- Presentation Layer (Frontend)
- Application Layer (Backend APIs)
- Database Layer (MySQL)

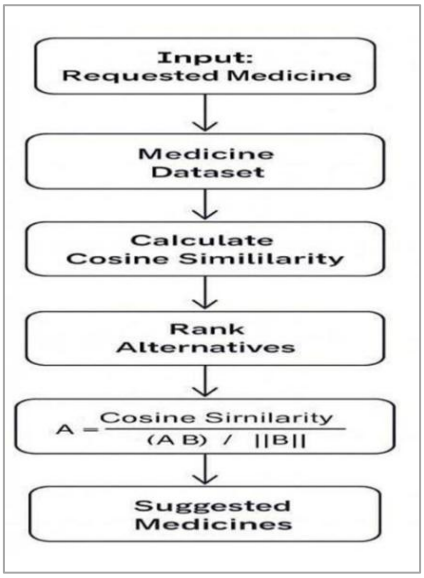
3. Implementation
Role-based authentication is implemented to provide secure access for different users. Key features include:
- Appointment booking
- Teleconsultation via Google Meet
- E-prescription generation
- Inventory management

4. Machine Learning Model (Medicine Recommendation)
An unsupervised model is used to recommend alternative medicines:
- **TF-IDF:** Converts medicine descriptions into numerical vectors
- **Cosine Similarity:** Measures similarity between medicines

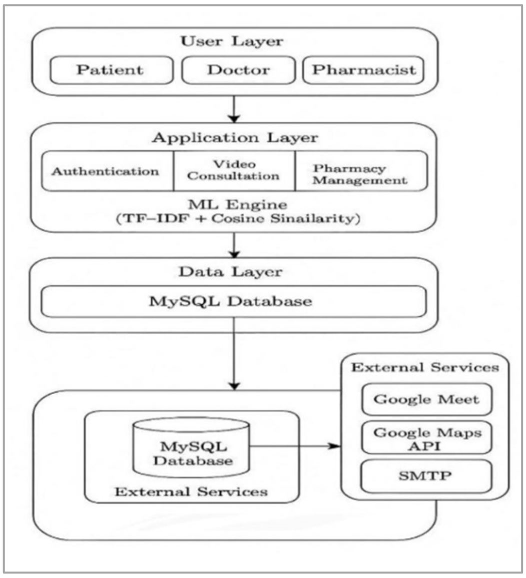
5. Testing

The system was tested using unit testing, integration testing, and user acceptance testing to ensure functionality and performance.

6. Deployment
The application was deployed on a local/cloud server with optimized database and API performance.



TF-IDF Cosine Architecture Flowchart



System Architecture

RESULTS

1. Functional Outcomes
A centralized healthcare platform was successfully developed connecting patients, doctors, and pharmacists. Secure authentication and role-based dashboards were implemented. Patients can book appointments, doctors provide consultations, and pharmacists manage inventory efficiently.

2. System Validation
All modules including authentication, consultation, prescription generation, and pharmacy management were validated using test datasets. The system showed smooth performance and user-friendly interaction.

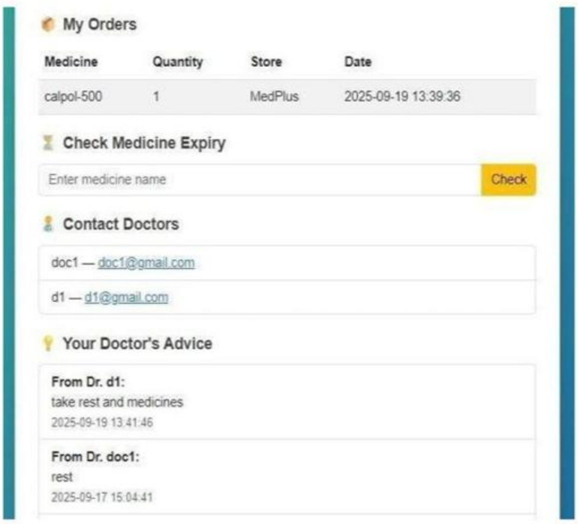
3. Machine Learning Performance

- Cosine similarity scores ranged between 0.82 – 0.94
- Top-1 Accuracy: 82%
- Top-3 Accuracy: 94%

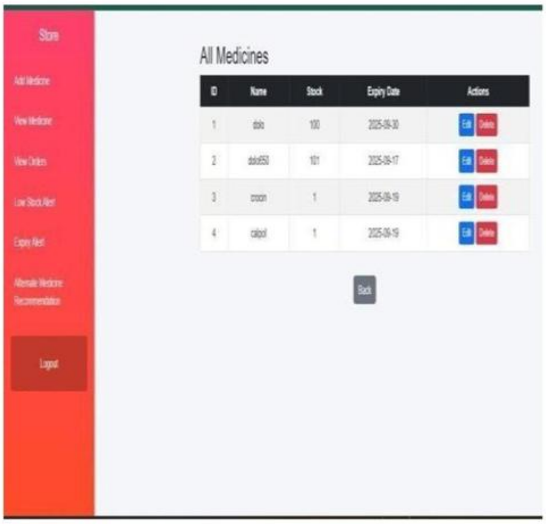
As shown in the accuracy graph on page 10, the model performs efficiently in recommending correct alternatives.

4. Performance Metrics

- Average system response time: < 2–3 seconds
- ML model response time: < 1 second
- High user satisfaction due to seamless integration



Patient Interface

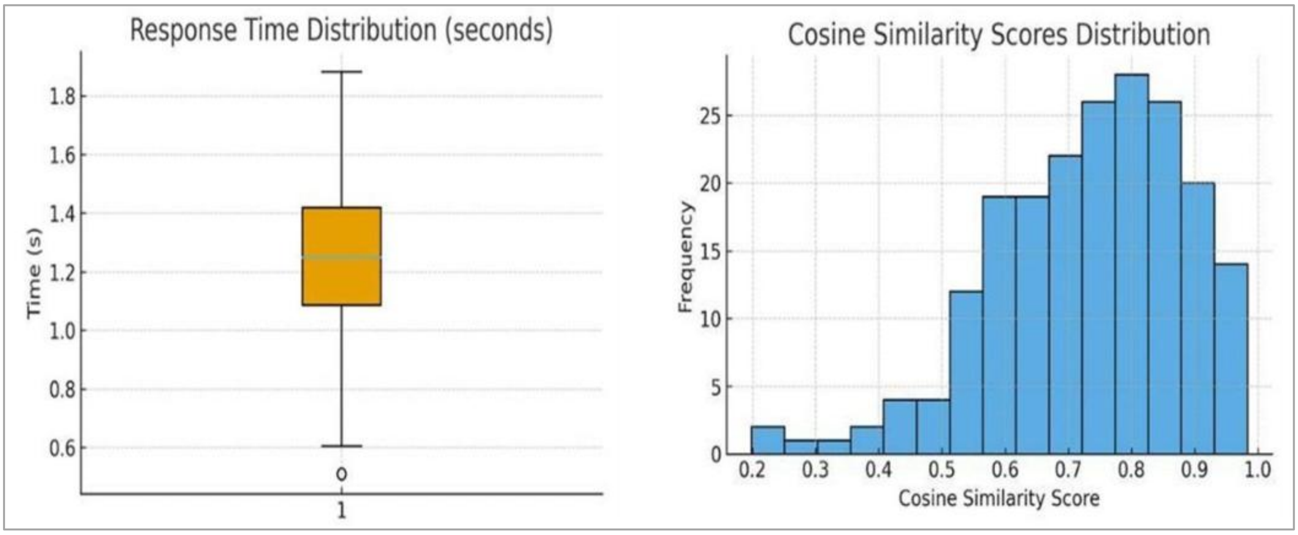


Pharmacy Management

***Corresponding Author:** Divyashree S

Query Medicine	Top-1 Recommendation	Cosine Score	Top-3 Recommendations
Paracetamol 500mg	Dolo 650	0.94	Dolo 650, Crocin, Calpol
Ibuprofen	Brufen	0.91	Brufen, Advil, Nurofen
Amoxicillin	Augmentin	0.95	Augmentin, Moxatag, Trimox

SAMPLE QUERY RESULTS



DISCUSSION

The results demonstrate that PharmaLink effectively bridges the gap between consultation and pharmacy systems. Unlike existing platforms that focus on only one aspect, PharmaLink integrates teleconsultation, prescription management, and pharmacy services into a single platform.

The machine learning model enhances system intelligence by recommending alternative medicines without requiring labelled training data. Additionally, automated inventory alerts improve pharmacy efficiency and reduce wastage due to expired medicines.

Overall, the system improves healthcare accessibility, enhances patient experience, and ensures better coordination among stakeholders.

CONCLUSION

Pharma Link provides a comprehensive digital healthcare solution by integrating patients, doctors, and pharmacists into a unified platform. It ensures seamless consultation, efficient pharmacy management, and intelligent medicine recommendation. The system improves accessibility, reduces inefficiencies, and enhances continuity of treatment.

FUTURE WORK

- Mobile Application (Android/iOS)
- Advanced NLP models for improved recommendations
- Multilingual support for wider accessibility
- Integration with national healthcare databases
- AI-based fraud detection and analytics

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***Corresponding Author:** Divyashree S