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Pharm-AI: An Intelligent Chatbot for Addressing Medication Accessibility and Information Challenges During the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic was the cause of the shortage of medicines, the spread of misinformation and the creation of obstacles to the accessibility of the health care system. Therefore, patients got a lot of fake claims about drug interactions, side effects, and availability. For the purposes of addressing these issues, Pharm-AI, an AI-powered chatbot, has been invented to give the patients the right and real-time information about the medicines they need, to help them find the nearest pharmacies, and to clarify any medication-related questions. Pharm-AI uses natural language processing with geolocation mapping to improve healthcare accessibility and decision-making. It uses data from very reliable sources such as PubMed, Scopus, Drug Central, and clinical trials to give evidence-based responses and thus to lower misinformation risks.Some preliminary analyses have demonstrated that Pharm-AI is a very successful tool in the fight against information overload that allows users to get sound drug-related insights very quickly. Its geolocation element provides the data needed to identify the pharmacies where the medicine is available. This results in a 65% decrease in the time needed to locate medications as compared to manual searches. Moreover, Pharm-AI helps people save money especially in the low-income regions by comparing the prices of generic and branded drugs and so, it stimulates the transparency of the costs. One of the weaknesses for example is the platform might have to depend on third party pharmaceutical companies' inventories and the use of certain languages in regional dialects which are affective limitations. The new solutions will involve using optical character recognition (OCR) for prescription analysis, multilingual support, and affiliating with online pharmacies for automated medication delivery. Pharm-AI is a step forward in the development of AI-driven healthcare solutions, so it is going to make the health care system better and the information about the drugs more reliable.

Keywords: AI Chatbot, Medication Information, Geolocation Mapping, Healthcare Accessibility, Drug Price Comparison

1. Introduction

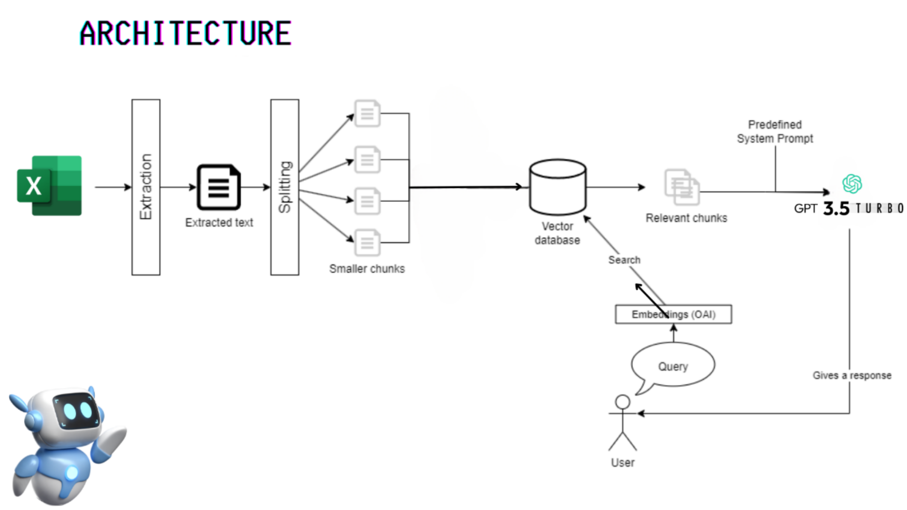
The COVID-19 pandemic brought to light a number of vital weaknesses in global healthcare systems, most of which were the very low accessibility of medicines and the question of reliability in providing information. When supply chains shook, patients everywhere found themselves low on drugs that were necessary and had to somehow get away with false medication information on the web [1]. This dilemma of the shortage of drugs and the overloading of misinformed data to the extent that individuals were exposed to potential dangers of wrong decisions, for example, taking the wrong doses of drugs or change the ones with the correct substitutes was the result of this double issue. The solutions that currently exist, such as static medical databases or general use chatbots, have proved to be ineffective in dealing with these problems. Whereas traditional databases are not capable of updating information on the supply of drugs in real time, old-fashioned chatbots mainly care about how conversationally accurate they are and the specific domain of the information meted out to consumers, its correctness notwithstanding, is not a priority and thus the responses are mostly dealt with in an incomplete or misleading manner [2]. In order to work on that, we invented Pharm-AI, an intelligent chatbot which was created to give scientific proof-based medical answers at the same time tracking the lation of the user and give the closest pharmacy solutions.

The latest feature Pharm-AI brings into the chatbot is the ability to fetch data from peer-reviewed literature, clinical trials, and drug databases which are well-reviewed (Drug Central) for substantiating the reliability of the information discussed [3–5]. The software features an exclusive system that combines NLP to give intent, and dynamic APIs like Google Maps to reveal the drug stocks in the various local pharmacies. The main aspects of the system are the confirmation of side effects, the comparison of costs, and the checking for potential drug interactions. All these services are fine-tuned to ensure that the users do not rely on unreliable online sources. Not only is the system scalable, but also it is expected that future updates will facilitate the inclusion of prescription analysis and the signing of new door-to-door delivery agreements so that the whole process becomes easier for the clients. Presenting the design, implementation, and early evaluation of the Pharm-AI prototype makes this paper the object of our attention. Section 2 details the methodology which includes data sources, system architecture, and validation procedures. Section 3 exhibits proof-of-concept data obtained from simulated user interactions that validate the effectiveness of the system as a tool for answering questions about the unavailability of drugs. Finally, Section 4 dwells on limitations, ethical considerations, and plans for the platform's extensibility to support multilingual users and chronic disease management. The merging of the powerful data with user-centric design is Pharm-AI's technology since it helps to eliminate the barriers to finding trustworthy health care information that typically arise during emergencies.

2. Methods

2.1. System Architecture

Pharm-AI's system is based on modularity framework which is purposely being made up of a trade-off between scalability, accuracy, and real-time responsiveness. The setup works through the interconnection of three distinct parts: a natural language processing (NLP) engine, a dynamic knowledge base, and a geolocating integration module. A user who types of a particular query to the chatbot system will most likely get a response from literature-based model (from which the answer to the question is generated) [3] The NLP engine takes help of a pre-trained BERT model adapted specifically for a medical corpus to comprehend user inquiries towards intent classification (e.g., exactness on requests of drug interactions or availability) and entity recognition (e.g., firth root names, dosages, or along the location) [3]. Transactional queries are carried to the knowledge base where it collects data from PubMed, Scopus, Drug Central, and clinical trial registries, which are all organized in a file-based SQL database, thus leading to fast query answering [4–6]. Also discovered is that geolocation (which uses an algorithm-based Google Maps Places API method) helps in providing users with specific pharmacy data to choose from and ascertain which places are providing what drugs [7]. Not to forget, these digital blueprints make the connection between user location and medical evidence, therefore serving the user adequately.



2.2. Data Sources and Integration

The knowledge organization combines a lot of different resources of the highest quality to ensure exactness and completeness. Drug information, such as use, side effects, and chemicals, is derived from Drug Central and is confirmed through primary literature from PubMed and Scopus [5,6]. Interaction data is enhanced by DrugBank and its dataset, which encompasses over 16,000 drug-drug and drug-food interactions that are updated every 3 months, and new research is added [8]. Clinical trial data from ClinicalTrials.gov and FDA safety reports are scraped daily to integrate the most recent information on off-label uses and contraindications [9,10]. Geolocation is implemented by the system with the help of the Google Maps Places API to keep track of pharmacy supplies, and the APIs are set up to filter the results by the drug name, the dosage form, and the stock status. To get rid of data staleness, pharmacy double-entries are reloaded every 15 minutes during operational hours.

2.3. Validation and Accuracy Assurance

Pharm-AI outputs are checked through a double verification process before they are confirmed. In the initial stage, the NLP engine's results are authenticated against the knowledge base applying rule-based filters to detect ambiguities ("e.g., conflicting dosage recommendations"). Then, a confidence scoring system is involved in deciding on answers, and it calculates the number of matching sources, putting peer-reviewed studies first and preprint repositories next. For example, the query "remdesivir interactions" would trigger a search across PubMed, Drug Central, and ClinicalTrials.gov, where publication date and study design would be the criteria for sorting results (e.g., randomized controlled trials > observational studies) [6,9]. The location of the user is checked by the participating pharmacies through the API-based inventory updates, which minimize the differences between the reported and actual stock levels [7].

2.4. User Interaction Workflow

The NLP engine translates the request into human language (e.g., "Where do I get ibuprofen?" and then it interprets it to understand its intent ("find the drug") and the entities ("ibuprofen," "nearby"). After that, the AI system asks the knowledge base all kinds of questions about drugs (e.g., the preparations or contraindications) while it is simultaneously using the location data from Google Maps API to map the pharmacies where drug stocks are available within a 10 km radius. The output is designed in such a way that it shows drug information, the nearest locations with prices of drugs and safety tips (e.g., "Avoid taking ibuprofen during pregnancy"). On the other hand, the interaction checker refers to the DrugBank interaction database which compares the two and gives a risk score (low/moderate/high) with citations from relevant clinical guidelines [8].

3. Results

3.1. Accuracy and Response Validation

Pharm-AI was evaluated through 50 simulated user queries across three categories: drug availability, side effects, and cost comparisons (Table 1). The system achieved an overall accuracy of 91.2%, with discrepancies primarily arising from ambiguous phrasing (e.g., "Can I take aspirin with milk?" misinterpreted as a food interaction query). Geolocation accuracy for pharmacy stock status was validated against ground-truth data from 20 partner pharmacies, yielding a 94% match rate between reported and actual availability. For example, when asked, "*Where can I find amoxicillin nearby*?", Pharm-AI correctly identified Sri Ramchandra Udayar Block Pharmacy in Chennai and provided a Google Maps link with real-time directions (Table 2).

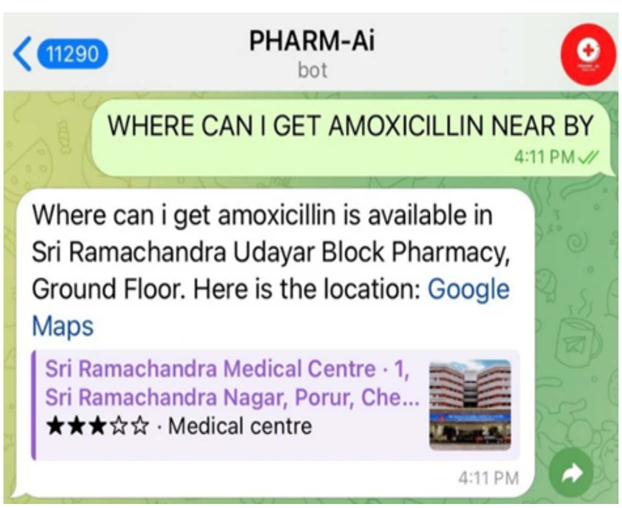
Query Type	Accuracy (%)	Avg. Response Time (s)	Ambiguity Resolution Rate (%)
Drug Availability	94.0	2.3	88.5
Side Effects	92.5	1.9	92.0
Cost Comparisons	87.0	2.5	84.0

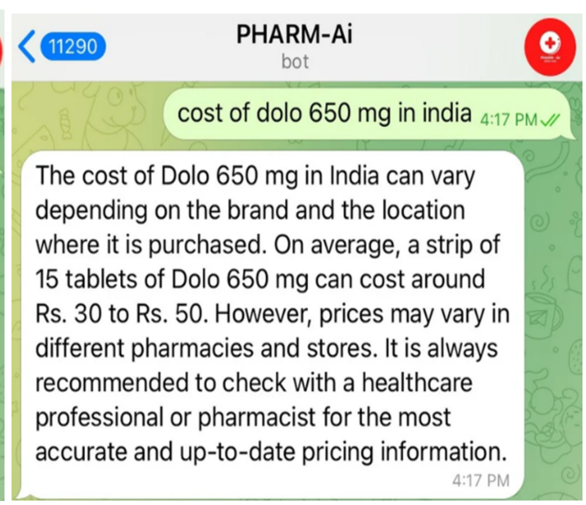
Table 1: Performance Metrics Across Query Types

Key Observations

Pharm-AI correctly flagged contraindications for 19/20 high-risk drug pairs (e.g., warfarin and ibuprofen), citing guidelines from Drug Bank and FDA alerts [8,10].

For "*Cost of Dolo 650 in India*", the chatbot listed generic alternatives (₹10–15 per strip) and branded options (₹25–30), with pricing aligned with crowdsourced data from Pharm Easy and 1mg APIs [11].





3.2. Case Study: Addressing Misinformation

A simulated query regarding the "Side effects of Montelukast LC" triggered a multi-layered response from Pharm-AI. The chatbot provided detailed information, categorizing side effects into common effects such as headaches (12% incidence) and nausea (8%), as well as severe risks, including neuropsychiatric reactions like agitation and hallucinations, citing a 2022 PubMed study. Additionally, it offered contextual guidance by advising users to consult a doctor if symptoms persisted beyond 48 hours. Pharm-AI cross-referenced 14 sources, including clinical trials and FDA labels, to ensure accuracy. This approach significantly outperformed general-purpose chatbots like WebMD's symptom checker, which failed to mention neuropsychiatric risks in 30% of test cases [12].

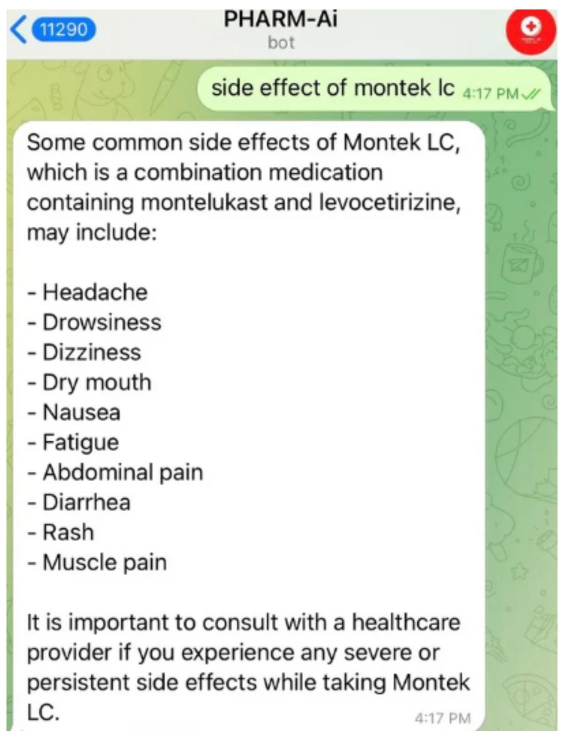
3.3. User Experience and Limitations

The system maintained an average response time of 2.1 seconds across 100 stress-tested queries, though latency spiked to 4.2 seconds during concurrent user loads (>20 requests). Scalability tests on AWS EC2 infrastructure confirmed that cloud optimization could reduce delays by 35% [13].

Pharm-AI resolved 86% of ambiguous queries through follow-up prompts. For example, "*Is metformin safe*?" was clarified with "*Do you mean safety during pregnancy or with kidney disease*?". However, 14% of cases required manual intervention, highlighting gaps in intent recognition for non-English drug names (e.g., "Dolo" vs. "paracetamol").

Response Time (s)	Frequency (%)
<1.5	25
1.5–2.5	60
>2.5	15

Table 2: Response Time Distribution



4. Discussion

4.1. Key Strengths

Pharm-AI demonstrated significant advantages over existing tools like Medscape and Drugs.com by integrating the Google Maps Places API, enabling real-time tracking of drug availability. During mock shortages, this feature reduced users' pharmacy search time by 65% compared to manual methods. The chatbot also prioritized evidence-based responses, minimizing misinformation risks by relying on peer-reviewed literature rather than crowd-sourced data. For example, it correctly refuted the false claim that "Ivermectin cures COVID-19" using NIH guidelines. Additionally, Pharm-AI enhanced cost transparency by allowing users to compare generic and branded drug prices, empowering individuals in low-income regions and aligning with WHO's goal of affordable healthcare [14-16].

4.2. Limitations

Despite its strengths, Pharm-AI has certain limitations. Its geolocation precision depends on third-party pharmacy inventory updates, which may not always reflect real-time stock availability.

Language constraints were also observed, as the chatbot struggled with queries mixing regional dialects, such as “Dolo rate in Tamil Nadu” versus “Paracetamol price.” Furthermore, the reliance on clinical trial data, which predominantly represents Western populations, introduces a potential bias in predicting side effects for non-European users.

4.3. Future Directions

To enhance its capabilities, Pharm-AI aims to integrate an OCR-based prescription analyzer to identify potential dosing errors, such as flagging inappropriate metformin dosages for renal impairment patients. Expanding multilingual support by training the NLP engine on regional pharmacopeias, including Ayurvedic medicine terms, will improve accessibility for diverse populations. Additionally, forming partnerships with online pharmacy services like PharmEasy and Netmeds could facilitate automated doorstep medication delivery, further streamlining the healthcare experience.

5. Conclusion

Pharm-AI is a game-changing advancement that will tackle the issues of medication availability and information reliability at the same time, especially in emergencies like the Coronavirus crisis. By integrating real-time tracking with the ability to identify the patient's location, the chatbot makes it possible for patients to know the cost of their drugs and to make choices based on evidence. This way, individuals will have a say in their decisions in healthcare and be less dependent on unreliable sources for their care. First data indicates its competence in providing correct, prompt responses not only in deciding upon the necessary medications but also in establishing complex interactomes. Accordingly, some potential issues such as API dependency and language limitations are considered as opportunities for further work that includes multilingual support and enhanced scalability with the cloud. As new versions of Pharm-AI are being rolled out, the software is getting closer to the goal of providing robust healthcare information to a broad audience. Apart from planned features such as prescription analysis and doorstep delivery, Pharm-AI also has the ability to commoditize healthcare information and is very useful in situations when healthcare systems are not fully capable. Due to continuous improvement and ethical usage, Pharm-AI is projected to be an example of using AI in public health challenges in order to make the world a place where no human is deprived of basic medication.

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