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AI-Based Prescription Interpretation with Healthcare Support

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Abstract: ***The AI-Based Healthcare Prescription Interpretation with Healthcare Support Application is an intelligent mobile healthcare solution designed to simplify the understanding of medical prescriptions and enhance medication management. The application enables users to upload or capture images of handwritten or printed prescriptions and medical reports using their mobile devices. These inputs are processed using advanced image recognition and natural language processing techniques to accurately extract and interpret medication details and essential health information. An integrated AI-powered chatbot further enhances user interaction by providing simplified explanations of prescribed medicines, addressing user queries, recommending general precautions, and suggesting personalized dietary guidance based on medication usage. To ensure inclusivity and accessibility, the application supports multiple languages, including English, Telugu, and Hindi, making it suitable for a diverse user population. Additionally, the application securely stores prescription data and user interaction history, enabling users to access and review past records whenever needed.***

Keywords: Multimodal AI, Gemini 2.5 Flash, Healthcare Informatics, Prescription Analysis, Django Framework, Geospatial Services, OCR, Medication Adherence.

I. INTRODUCTION

The rapid adoption of digital technologies in healthcare has significantly improved patient care, data management, and operational efficiency. However, a critical challenge persists in the final stage of healthcare delivery, commonly referred to as the "last mile," where patients interpret and act upon physicians' prescriptions. Handwritten prescriptions remain widely used and are often difficult to decipher, leading to medication errors, delays in drug procurement, and reduced treatment effectiveness.To address these limitations, this paper proposes an AI-Powered Healthcare Management System that facilitates accurate interpretation of medical prescriptions and enhances patient support. The proposed system utilizes multimodal artificial intelligence techniques, integrating image processing and natural language processing, to automatically extract and interpret relevant information from prescription images. This approach eliminates the need for manual data entry and minimizes the risk of human error. The system is developed as a web-based application using the Django framework, ensuring scalability, maintainability, and secure handling of sensitive healthcare data. In addition to prescription interpretation, the system provides value-added features, including location-based identification of nearby pharmacies and automated medication reminders to improve adherence. The primary objective of the proposed system is to provide patients with an intelligent and reliable platform that simplifies prescription understanding, supports medication management, and enhances accessibility to healthcare services.

II. LITERATURE SURVEY

Recent advancements in artificial intelligence and digital healthcare have significantly contributed to improving medical data interpretation and patient support systems. The integration of multimodal AI models has enabled systems to process both textual and visual data effectively. The work by Google DeepMind [1] introduces Gemini, a powerful generative AI model capable of multimodal understanding, demonstrating the potential for interpreting complex inputs such as medical prescriptions that combine handwritten text and structured information.

Web-based healthcare applications require robust and scalable frameworks for deployment. The Django framework [2] has been widely adopted due to its security features, rapid development capabilities, and scalability, making it suitable for healthcare management systems that handle sensitive patient data.

Location-based healthcare services are increasingly being integrated into digital platforms to enhance accessibility. The Geopy library [3] provides efficient geocoding and distance computation functionalities, which are essential for identifying nearby pharmacies and healthcare facilities. Distance calculation techniques such as the Haversine formula [9] further support accurate spatial analysis in such applications.

Standardization in healthcare data management is critical for interoperability and system design. The IEEE standard for Personal Health Records (PHR) [4] defines architecture and functional requirements that guide the development of secure and patient-centric healthcare applications.

Several studies have focused on automating the recognition of handwritten medical prescriptions. Smith et al. [5] explored deep learning techniques for prescription recognition, highlighting the challenges associated with handwriting variability and the importance of accurate text extraction. Similarly, Zhang [6] conducted a comparative analysis of large language models (LLMs) in clinical entity recognition, demonstrating their effectiveness in extracting meaningful medical information from unstructured text.

Medication adherence remains a significant challenge in healthcare systems. The World Health Organization [7] emphasizes the role of digital solutions, such as reminder systems and mobile applications, in improving patient compliance and reducing treatment errors. Additionally, advancements in natural language processing, as demonstrated by Brown et al. [8], have enabled systems to understand and respond to user queries effectively, supporting the development of intelligent healthcare chatbots.

The transition from traditional paper-based systems to AI-driven healthcare solutions has been widely discussed in recent research. Studies such as [10] highlight the benefits of digital transformation in improving efficiency, reducing errors, and enhancing patient engagement.

Despite these advancements, existing systems often lack an integrated approach that combines prescription interpretation, patient interaction, medication management, and location-based healthcare services into a single platform. The proposed system addresses this gap by leveraging AI, web technologies, and geospatial analysis to provide a comprehensive healthcare support solution.

III. EXISTING SYSTEM

The existing prescription management process is predominantly manual and relies heavily on physical documentation. In this approach, patients carry handwritten prescriptions to pharmacies, where pharmacists are responsible for interpreting the content. While this traditional system has been widely practiced, it presents several limitations that can adversely affect patient care and treatment outcomes.

Firstly, handwritten prescriptions are often prone to misinterpretation due to unclear or illegible handwriting. This increases the risk of dispensing incorrect medications or dosages, which may lead to serious health consequences. Secondly, the absence of digitization results in poor record management. Patients frequently misplace or lose physical prescriptions, leading to the loss of important medical history and making it difficult to track ongoing treatments.

Furthermore, medication adherence is largely dependent on the patient's memory or manually set reminders. This manual scheduling approach is unreliable and often results in missed doses or incorrect timing, thereby reducing the effectiveness of the prescribed treatment. In addition, the process of locating pharmacies that stock required medications is inefficient. Patients typically rely on manual searches or multiple inquiries, which can be time-consuming and inconvenient.

IV. PROBLEM STATEMENT

Despite advancements in digital healthcare technologies, the process of interpreting handwritten medical prescriptions and managing medication-related tasks remains largely manual and error-prone. There is a critical need for an intelligent system that can automate the digitization of handwritten prescriptions and accurately extract relevant medical information.Furthermore, patients often lack a clear understanding of prescribed medications, including dosage instructions and precautions, highlighting the necessity for semantic interpretation of prescription data in a user-friendly manner. In addition, the absence of integrated location-based services makes the process of identifying nearby pharmacies inefficient and time-consuming.

V. PROPOSED SYSTEM

The proposed system is a comprehensive AI-driven healthcare platform developed using the Django web framework. It is designed to manage the complete lifecycle of prescription handling, starting from data extraction to patient support and medication adherence. By integrating artificial intelligence, modern web technologies, and geospatial services, the system provides an efficient, scalable, and user-centric solution aimed at improving healthcare accessibility and reducing manual intervention.

The system consists of several core modules that collectively ensure seamless functionality. The AI Prescription Analyzer module is responsible for processing uploaded prescription images. It leverages the Gemini 2.5 Flash model to perform optical character recognition (OCR) and extract structured medical information such as medicine names, dosage instructions, and frequency of intake. The extracted information is then converted into a machine-readable format, enabling further analysis and system integration.

The Personalized Dashboard serves as a centralized interface for users to manage their healthcare data securely. It allows patients to view and track uploaded prescriptions, monitor active medication schedules, and access their chatbot interaction history. This module enhances user engagement by providing a clear and organized view of all relevant health information in one place.

In addition, the system incorporates a Context-Aware Medical Chatbot that assists users in understanding their prescriptions. The chatbot utilizes the user's prescription history as contextual input, allowing it to generate personalized and relevant responses. It can explain medication usage, clarify dosage instructions, and provide general healthcare guidance, thereby improving patient awareness and confidence.

Furthermore, the Geospatial Pharmacy Locator enhances the system's practicality by enabling users to identify nearby pharmacies. This module uses geospatial computations based on the Haversine formula, implemented through the Geopy library, to calculate the distance between the user's current location and available pharmacy locations. This feature simplifies the process of procuring medicines and reduces the time and effort required for manual searches.

From a technical perspective, the system is built using a robust and efficient technology stack. The backend is developed using Django, a Python-based web framework known for its scalability and security. The AI functionality is powered by the Gemini 2.5 Flash model, integrated through an API for efficient processing of prescription data. SQLite is used as the database for storing structured information related to users, prescriptions, and reminders. The frontend is implemented using HTML5, CSS3, and JavaScript, with AJAX support to enable real-time interactions, particularly for chatbot communication. Additionally, geospatial processing is handled using the Geopy library, which facilitates accurate distance calculations and location-based services.

VI. METHODOLOGY

The proposed system follows a structured and linear processing pipeline that transforms a raw prescription image into actionable healthcare information. This methodology integrates image processing, artificial intelligence, data storage, and geospatial analysis to deliver a seamless user.

A. Processing Pipeline

The workflow begins with image acquisition, where the user uploads a prescription image through the system interface. Once uploaded, the image is converted into a Base64-encoded string along with its MIME type to ensure compatibility with the multimodal AI model. This encoded data is then forwarded to the AI inference stage, where a structured prompt is sent to the Gemini 2.5 Flash model. The model processes the image and generates a response in a predefined JSON format containing extracted medical details.

Following this, the system performs JSON parsing to separate the response into two components: the complete OCR-extracted raw text and a structured list of medicines with attributes such as name, dosage, and frequency. The processed data is then stored in the system database, where the extracted information is linked to the corresponding prescription record. This ensures persistent storage and easy retrieval for future use.

B. Algorithm for Pharmacy Discovery

The system employs a distance-based filtering algorithm to identify nearby pharmacies efficiently. Initially, the user's geographic coordinates, including latitude and longitude, are obtained. The system then retrieves the coordinates of all registered pharmacies from the database. Using geodesic distance computation based on the Haversine formula, the distance between the user and each pharmacy is calculated. Pharmacies within a predefined threshold distance are filtered and stored in a list of nearby locations. Finally, the system returns the top closest pharmacies, typically limited to ten results, to ensure relevance and usability.

C. System Architecture

The system architecture follows a layered design approach to ensure modularity, scalability, and maintainability. The user interface layer consists of a web browser through which users interact with the system by uploading prescriptions, accessing the dashboard, and communicating with the chatbot. The application layer is implemented using Django views, which handle authentication, request routing, and business logic execution.

The intelligence layer integrates the Gemini 2.5 Flash model, which performs OCR, semantic analysis, and structured data extraction. The service layer includes geospatial processing using the Geopy library to compute distances and identify nearby pharmacies. Finally, the persistence layer consists of an SQLite database and media storage, where user profiles, prescription records, and reminder schedules are securely maintained.

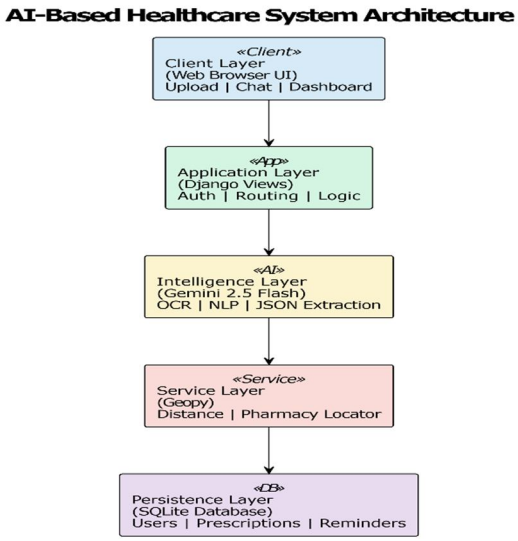

Fig.1.Architecture Diagram

D. Flowchart

The operational flow of the system begins with user authentication, followed by prescription image upload. The uploaded image is processed by the AI model to extract structured information. A validation step ensures whether the returned JSON is correctly formatted. If the JSON output is valid, the system extracts the medicine details, displays the interpreted information, enables reminder scheduling, and provides pharmacy location services. If the JSON output is invalid, the system displays the raw extracted text and allows manual review.

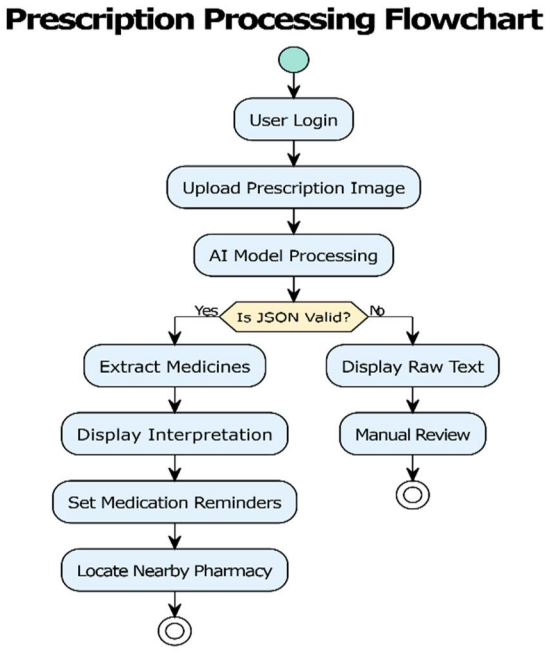

Fig.2 .Flowchart Diagram

VII. RESULTS AND DISCUSSION

The proposed system was evaluated based on its effectiveness in processing diverse handwritten prescriptions and providing accurate, timely, and meaningful outputs. The evaluation focused on key performance aspects, including extraction accuracy, system latency, and geospatial efficiency.

A. Performance Analysis

The AI-based prescription analyzer demonstrated a high level of extraction accuracy. The use of the Gemini 2.5 Flash model significantly outperformed traditional OCR techniques, such as Tesseract, particularly in recognizing complex medical terminology, handwritten text variations, and dosage patterns. This improvement in accuracy reduces the likelihood of misinterpretation and enhances the reliability of the extracted data.

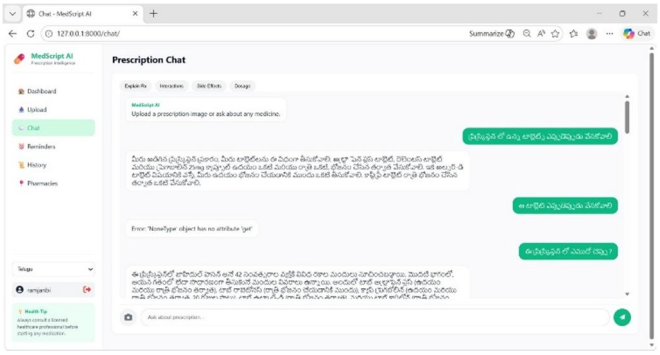

Fig.3.Precription Analysis

In terms of system responsiveness, the overall latency from image upload to final interpretation was observed to be approximately 3–5 seconds. This processing time includes image encoding, API communication, AI inference, and data parsing. The latency is primarily influenced by network conditions and API response time, but remains within an acceptable range for real-time user interaction.

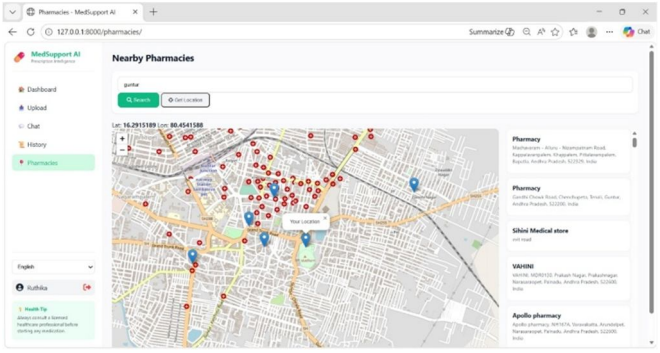

Fig.4.Pharmacy Location Tracking

The geospatial pharmacy locator module exhibited high efficiency in identifying relevant nearby pharmacies. By leveraging optimized distance calculations, the system was able to filter and rank a large set of pharmacy records, returning the most relevant results almost instantaneously. This ensures a seamless user experience in locating required medications.

B. Discussion

The integration of a context-aware medical chatbot enhances the overall functionality of the system by transforming it from a simple data extraction tool into an intelligent healthcare assistant. By incorporating historical prescription data into the chatbot's context, the system is capable of answering personalized queries, such as retrieving past medication details or clarifying previous dosage instructions. This contextual capability provides a longitudinal perspective on patient health, enabling users to track their medication history and make more informed decisions. As a result, the system not only improves prescription interpretation but also contributes to better patient engagement, awareness, and adherence to treatment plans.

VIII. CONCLUSION

This research presents the successful design and implementation of an AI-powered healthcare management system that addresses the challenges associated with manual prescription handling. The proposed system effectively automates the digitization and interpretation of handwritten prescriptions by leveraging advanced large multimodal models integrated within a robust web-based framework. By combining artificial intelligence with geospatial services, the system significantly reduces the risk of medication

errors, improves prescription clarity, and enhances overall patient autonomy in managing healthcare activities.

The system demonstrates several key advantages. It enables automated extraction of unstructured data from handwritten prescription images, thereby eliminating the need for manual transcription. The integration of a context-aware AI chatbot provides personalized medical insights and supports user queries based on historical prescription data. Additionally, the built-in medication reminder system improves adherence to prescribed treatments, ensuring timely dosage intake. The inclusion of real-time pharmacy location services further streamlines access to medicines by allowing users to identify nearby pharmacies efficiently.

Despite these contributions, there remains scope for further enhancement. Future work will focus on integrating real-time pharmacy inventory APIs to enable users to verify the availability of prescribed medicines before visiting a pharmacy. Moreover, the incorporation of blockchain-based solutions for maintaining prescription records can improve data security, integrity, and controlled sharing between healthcare providers and patients. These advancements will further strengthen the system's reliability, scalability, and applicability in modern digital healthcare environments.

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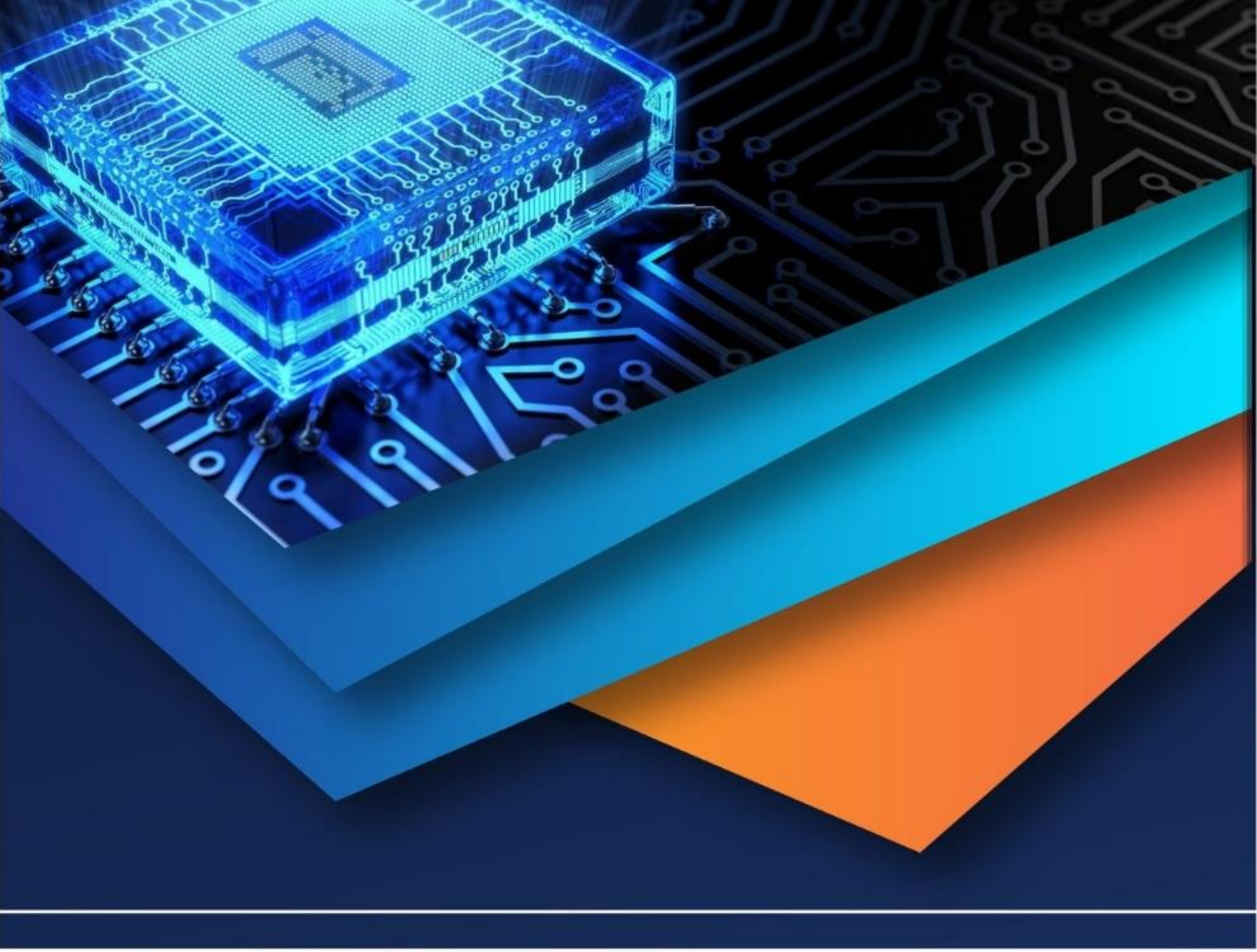

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