

AI-Driven OCR-Based Medical Prescription Scanner and Management System

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Abstract — Medical prescriptions are often handwritten or printed in formats that are difficult for patients to interpret and manage effectively. Misunderstanding medication names, dosage, or timing can lead to improper medication usage and serious health risks. According to global healthcare reports, nearly 40% of medication errors are attributed to illegible prescriptions. This paper presents an AI-Driven OCR-Based Medical Prescription Scanner and Management System developed using Flask and Tesseract OCR. The system enables users to upload prescription images through a secure web interface, automatically extract textual information using OCR, and organize the extracted data using rule-based natural language parsing techniques without requiring any predefined dataset or machine learning model. The parsed prescription data is stored in a relational database, enabling patients to view prescription history, track medication schedules, and manage reminders through an interactive dashboard. Experimental evaluation on 50 prescription samples — comprising both handwritten and printed formats — demonstrates an OCR extraction accuracy of 85%, with medicine name detection at 83% and dosage extraction at 87%. The average system response time remains under 2 seconds per prescription. The proposed system provides a practical, lightweight, and scalable solution for healthcare digitization, suitable for deployment in small clinics and resource-constrained environments.

Keywords — Optical Character Recognition (OCR), Medical Prescription, Flask, Tesseract, Rule-Based Parsing, Healthcare Digitization, Medication Management, Web Application

I. INTRODUCTION

The global healthcare system continues to grapple with the challenge of medication errors, a problem that affects millions of patients annually. A significant root cause of these errors lies in the illegibility and complexity of handwritten medical prescriptions. Healthcare professionals often use abbreviations, shorthand notations, and handwriting styles that are difficult for patients — and sometimes even pharmacists — to correctly interpret. The resulting misinterpretations lead to incorrect dosages, wrong medication administration, missed doses, and in severe cases, life-threatening adverse events.

The World Health Organization (WHO) has identified medication errors as one of the leading causes of harm in healthcare globally, estimating that medication-related errors cost billions of dollars annually in avoidable hospitalizations and treatments [1]. In developing nations like India, where primary healthcare infrastructure may be limited, the problem is further compounded by a lack of digital prescription management tools accessible to the general population.

Conventional approaches to prescription management include manual transcription by pharmacists, paper-based filing by patients, or expensive proprietary Electronic Health Record (EHR) systems that require significant investment and technical expertise to operate. While machine learning-based OCR systems have been explored as potential solutions, they typically require large annotated datasets, powerful computing resources, and complex deployment pipelines — all of which are prohibitive for small clinics or individual use.

This paper addresses these limitations by proposing an AI-Driven OCR-Based Medical Prescription Scanner and

Management System — a lightweight, web-based application that leverages the open-source Tesseract OCR engine and a custom rule-based parsing framework built on top of the Flask web framework. The system requires no training data, operates within standard hardware constraints, and provides an end-to-end solution from prescription image upload to structured medication data and reminder management.

The key contributions of this paper are: (i) a dataset-free prescription digitization pipeline combining OCR and rule-based NLP; (ii) a secure, multi-user web application with prescription history and reminder tracking; (iii) experimental validation achieving 85% OCR accuracy across 50 real-world prescription samples; and (iv) a system architecture designed for scalable deployment in resource-constrained clinical environments.

The remainder of this paper is organized as follows. Section II reviews related work. Section III defines the problem statement. Section IV describes the proposed system architecture and modules. Section V details the technology stack. Section VI presents experimental results. Section VII outlines advantages. Section VIII concludes with future directions.

II. RELATED WORK

The digitization of handwritten and printed medical prescriptions has been an active area of research, with approaches spanning classical image processing, traditional machine learning, and modern deep learning techniques.

Ullah et al. [2] proposed a transformer-based OCR system using the TrOCR architecture pre-trained on the Roboflow prescription dataset. Their system achieved 81.3% accuracy on handwritten prescription text. While

the transformer model demonstrated strong generalization, the approach is computationally intensive and requires a substantial labeled dataset for fine-tuning, limiting its applicability in resource-constrained settings.

Biswas et al. [3] developed a hybrid deep learning model integrating Convolutional Neural Networks (CNN) and Multi-Layer Perceptrons (MLP) for multilingual prescription recognition. The model was designed to integrate with EHR workflows and achieved high accuracy across multilingual samples. However, the system demands GPU-grade hardware for both training and inference, making it unsuitable for low-cost deployment.

Samson et al. [4] combined YOLOv5 object detection with OCR text recognition to identify and extract medicine names from scanned prescription images. Their two-stage pipeline demonstrated improved localization of text regions but suffered performance degradation with highly variable handwriting styles across doctors from different regions.

Talekar et al. [5] investigated a CNN-LSTM hybrid architecture for interpreting doctors' handwritten notes, targeting a reading-level classification of prescription text. While the system showed promise in parsing complex sentence structures, the model training required significant domain-specific annotation effort.

A study published in *Procedia Computer Science* [6] applied Tesseract OCR in combination with image preprocessing steps including deskewing, binarization, and morphological operations, reporting approximately 98% accuracy on printed prescriptions. However, performance dropped considerably on handwritten inputs, and the system did not include prescription management or patient-facing features.

A review of existing literature reveals a consistent gap: most systems focus narrowly on OCR extraction accuracy while neglecting the complete patient-facing workflow — including prescription storage, history tracking, and medication reminders. Furthermore, the dependency on large annotated datasets and high-performance computing limits the real-world deployability of these systems. The proposed system addresses these gaps by combining Tesseract OCR with a rule-based parsing engine within a complete prescription management web application.

III. PROBLEM STATEMENT

Despite advances in medical technology, prescription management at the patient level remains largely manual and error-prone. The following core challenges motivate this research:

- **Illegibility of Handwritten Prescriptions:** Doctors' handwriting is often difficult for patients and pharmacists to read, contributing directly to medication errors involving incorrect drug names, dosages, and administration frequencies.

- **Lack of Dataset-Free Digitization Tools:** Existing OCR-based prescription systems rely on large, domain-specific labeled datasets for training. Small clinics and individual developers lack the resources to collect and annotate such data.
- **Absence of Integrated Patient Management:** Most existing tools are limited to text extraction and do not provide a comprehensive patient-facing system for storing prescription history, setting medication reminders, or tracking adherence.
- **Accessibility and Scalability Constraints:** Expensive EHR platforms and GPU-dependent AI models are not scalable to small clinics, rural healthcare centers, or individual patients who need lightweight, affordable solutions.
- **Structured Data from Unstructured OCR Output:** Raw OCR text is unstructured and requires intelligent post-processing to identify and separate medicine names, dosage values, frequencies, and doctor information into a usable format.

The proposed system directly addresses each of these challenges through a combination of image preprocessing, open-source OCR, rule-based NLP parsing, and a full-featured web application with user authentication, prescription storage, and reminder management.

IV. PROPOSED SYSTEM ARCHITECTURE

The proposed Medical Prescription Scanner and Management System is a full-stack web application designed around a five-module pipeline. Each module handles a distinct stage of the prescription digitization and management workflow, ensuring a clean separation of concerns and enabling independent scalability of individual components.

A. User Authentication Module

The authentication module provides secure multi-user access to the application. New users register by providing a username, email, and password. Passwords are hashed using Werkzeug's PBKDF2-SHA256 algorithm before storage, ensuring that plaintext credentials are never retained in the database. Session management is handled by Flask-Login, which maintains authenticated user sessions across requests. Each user's data — including uploaded prescriptions, parsed results, and reminders — is strictly scoped to their account, preventing cross-user data exposure.

B. Image Capture and Preprocessing Module

Users upload prescription images in JPEG or PNG format via the web interface. Before passing images to the OCR engine, a preprocessing pipeline is applied to improve text extraction accuracy. OpenCV performs grayscale conversion and adaptive thresholding to enhance contrast between text and background. Gaussian blur is applied to reduce noise, and morphological operations are used to close gaps in character strokes. Pillow handles format normalization and resolution standardization. These

preprocessing steps are critical for handling the variability in scan quality, lighting conditions, and handwriting styles encountered in real-world prescriptions.

C. OCR Processing Module

The preprocessed image is passed to the Tesseract OCR engine via the pytesseract Python wrapper. Tesseract applies a trained LSTM-based character recognition model to convert image pixels into machine-readable text. Importantly, no domain-specific retraining of the Tesseract model is performed — the system operates entirely on the pre-trained Tesseract engine, eliminating the need for a labeled prescription dataset. The OCR module outputs raw text that includes medicine names, dosage instructions, frequency notations, and other prescription elements in an unstructured string format.

D. Rule-Based NLP Parsing Module

The raw OCR text is processed by a custom rule-based parsing engine. The engine applies a sequence of regular expression patterns and keyword matching rules to identify and extract structured fields: medicine name, dosage value and unit, administration frequency (e.g., twice daily, every 8 hours), route of administration, duration, and prescribing physician details. Domain-specific medical abbreviations (e.g., OD for once daily, BD for twice daily, TDS for three times a day) are resolved through a lookup dictionary. The parsed data is serialized into a structured JSON format for storage and display. Entries with low extraction confidence — typically where OCR produced garbled output — are flagged for manual review.

E. Prescription Storage and Dashboard Module

Structured prescription data is persisted in an SQLite relational database managed through Flask-SQLAlchemy ORM. The database schema stores user profiles, raw OCR text, parsed prescription fields, upload timestamps, and reminder configurations. The web dashboard presents users with a paginated prescription history, individual prescription detail views, and adherence statistics visualized through summary cards. Users can configure medication reminders by specifying timing and frequency, which are stored and surfaced through the dashboard's notification panel. An administrative view provides aggregate statistics on prescription uploads and parsing success rates.

V. TECHNOLOGY STACK

The system is built entirely on open-source technologies, ensuring zero licensing cost and ease of community-supported maintenance. Table I summarizes the core components and their versions.

Component	Technology / Version
Web Framework	Flask 2.3.3
ORM / Database	Flask-SQLAlchemy 3.0.5 + SQLite

Authentication	Flask-Login 0.6.3 + Werkzeug 2.3.7
OCR Engine	Tesseract + Pytesseract 0.3.10
Image Processing	Pillow 10.0.1 + OpenCV 4.8.1.78
Parsing	Python re + custom NLP rules
Language	Python 3.x
Deployment	Local / Cloud (Render / Heroku)

Table I: System Technology Stack

Flask was selected as the backend framework due to its minimal footprint, rapid prototyping capability, and extensive ecosystem of extensions. SQLite was chosen for its zero-configuration deployment characteristics, which are appropriate for single-instance clinical deployments. For larger multi-clinic deployments, the ORM layer allows straightforward migration to PostgreSQL or MySQL without code changes. Tesseract OCR was preferred over commercial alternatives due to its open-source licensing, active development, and support for multiple languages — an important consideration for future multilingual prescription support.

VI. EXPERIMENTAL RESULTS AND DISCUSSION

The system was evaluated on a curated dataset of 50 medical prescription samples collected from outpatient clinical settings. The dataset comprised 30 handwritten prescriptions and 20 printed prescriptions, covering a range of medical specialties including general medicine, cardiology, and orthopedics. Prescription images were captured using both smartphone cameras and flatbed scanners to simulate real-world acquisition conditions.

Evaluation metrics included: (i) OCR character-level accuracy, measured against manually transcribed ground truth text; (ii) medicine name detection rate, measuring whether the parsing module correctly identified and extracted at least one medicine name per prescription; (iii) dosage extraction accuracy, measuring correct identification of dosage values and units; and (iv) end-to-end system response time from image upload to structured data display.

Metric	Score	Remarks
Total Samples Tested	50	30 handwritten, 20 printed
Overall OCR Accuracy	85%	After image preprocessing
Printed Prescription Accuracy	94%	High-quality scans
Handwritten Prescription Accuracy	79%	Variable handwriting styles
Medicine Name	83%	Rule-based NLP

Detection		parsing
Dosage Extraction Accuracy	87%	Regex pattern matching
Frequency Detection Accuracy	81%	Abbreviation lookup table
Avg. System Response Time	< 2 sec	Per prescription scan
False Positive Rate (parsing)	6%	Flagged for manual review

Table II: Experimental Evaluation Results

The results demonstrate that the preprocessing pipeline contributes significantly to OCR accuracy, particularly for handwritten samples where contrast enhancement and noise reduction are critical. The 6-percentage-point gap between printed (94%) and handwritten (79%) accuracy reflects the inherent variability of human handwriting and is consistent with findings reported in related literature [2][6]. The rule-based parsing engine achieved competitive field extraction rates without any training data, validating the feasibility of the dataset-free approach.

A comparison with related systems is presented in Table III. While deep learning approaches achieve higher raw accuracy on well-curated datasets, the proposed system offers significant advantages in deployment simplicity, zero training data requirement, and integrated patient management features.

System	Accuracy	Dataset	Management
Ullah et al. [2]	81.3%	Required	None
Biswas et al. [3]	High	Required	EHR Integration
Procedia CS [6]	~98%	Required	None
Proposed System	85%	Not Needed	Full Dashboard

Table III: Comparison with Related Systems

VII. ADVANTAGES AND LIMITATIONS

A. Advantages

- **Zero Training Data Requirement:** The system operates entirely on the pre-trained Tesseract OCR engine and rule-based parsing logic, eliminating the need for domain-specific labeled datasets.
- **Lightweight and Cost-Effective:** Built on open-source components with no licensing fees. Deployable on standard hardware without GPU infrastructure, making it accessible to small clinics and individual users.
- **End-to-End Patient Workflow:** Unlike existing systems that focus solely on OCR extraction, the proposed system covers the complete prescription management lifecycle — from image upload to structured data storage, history tracking, and medication reminders.

- **Secure Multi-User Access:** Password hashing and session-based authentication ensure that prescription data is securely scoped to individual users, meeting basic healthcare data privacy requirements.
- **Scalable Architecture:** The modular Flask-based architecture allows individual components — OCR engine, parsing logic, database — to be upgraded or replaced independently as requirements evolve.
- **Responsive Web Interface:** The web-based front-end is accessible across desktop and mobile browsers, ensuring patients can access their prescription data from any device.

B. Limitations

- **Handwriting Variability:** OCR accuracy on highly irregular or stylized handwriting remains at 79%, which may be insufficient for prescriptions with critical dosage information in some cases.
- **Language Limitation:** The current implementation is optimized for English-language prescriptions. Multilingual support requires additional configuration of Tesseract language packs and localized parsing rules.
- **No Drug Interaction Validation:** The system does not currently validate extracted medicines against drug interaction databases, which would be a critical safety feature for clinical deployment.

VIII. CONCLUSION AND FUTURE WORK

This paper presented an AI-Driven OCR-Based Medical Prescription Scanner and Management System — a practical, lightweight, and scalable solution to the widespread problem of prescription misinterpretation and medication non-adherence. By integrating the Tesseract OCR engine with a custom rule-based NLP parsing framework within a Flask web application, the system achieves 85% overall OCR accuracy and 83% medicine name detection on a 50-sample real-world prescription dataset, without relying on any machine learning training data.

The proposed system distinguishes itself from existing approaches by providing a complete patient-facing prescription management workflow: secure user authentication, prescription image upload, automated OCR extraction, intelligent structured parsing, relational database storage, prescription history viewing, and medication reminder management — all within a single, deployable web application. The system's sub-2-second response time and zero training data requirement make it particularly well-suited for deployment in resource-constrained clinical environments, rural healthcare centers, and individual patient use.

The comparative analysis in Table III demonstrates that while deep learning approaches achieve higher accuracy on curated datasets, they lack the deployment simplicity and integrated management features that characterize the proposed system. The proposed approach represents a

practical middle ground — competitive accuracy with far lower operational complexity.

Future work will focus on several directions. First, multilingual OCR support will be added by configuring Tesseract language packs for Tamil, Hindi, and other regional Indian languages, along with localized parsing rule sets. Second, the system will be extended with an AI-assisted drug interaction validation module that cross-references extracted medicines against publicly available drug interaction APIs such as OpenFDA. Third, voice-based reminder notifications and voice-to-text input will be implemented to improve accessibility for elderly and visually impaired patients. Fourth, integration with national EHR standards (e.g., FHIR-compliant APIs) will be explored to enable the system to function as a lightweight gateway to larger healthcare information ecosystems. Finally, the OCR module will be augmented with a fine-tuned handwriting recognition model trained on domain-specific prescription data to push handwritten accuracy beyond 90%.

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