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# VERIPILL:ML BASED COUNTERFEIT MEDICINE PREDICTION

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**Abstract:** Counterfeit medicines pose a major health risk in World, where visually identical fake drugs often reach consumers without detection. VeriPill is an ML-based platform designed to help users verify medicine authenticity through image analysis. The system combines Convolutional Neural Networks (CNN), Optical Character Recognition (OCR), and dataset validation to examine packaging features and extracted label details, identifying tampering and inconsistencies that indicate counterfeit products. Alongside verification, VeriPill offers a symptom-based medicine guide and a nearby pharmacy locator for added usability. Built using Python, Django, and OpenCV, the platform provides fast and accessible drug authentication, supporting safer medicine use and strengthening trust in the pharmaceutical ecosystem.

**Keywords:** counterfeit detection, CNN, OCR, computer vision, medicine authentication, AI in healthcare.

## I. INTRODUCTION

The circulation of counterfeit medicines in world has become a major public health concern, with many fake drugs appearing visually identical to genuine products and leaving consumers with no easy way to verify their authenticity. These counterfeit medicines often contain incorrect or unsafe ingredients, leading to poor treatment outcomes and serious health risks. To address this gap, Veripill offers an ai-powered platform that verifies medicine authenticity through simple image-based analysis. By combining machine learning techniques with accessible healthcare support tools, the system aims to provide users with a reliable method to check the genuineness of a medicine before use.

Key Components of VeriPill:

- CNN-Based Packaging Analysis – Uses deep learning to detect visual inconsistencies in the packaging.
- OCR Text Extraction – Reads printed details like batch numbers and expiry dates for verification. Dataset Validation – Compares extracted information with verified medicine records.
- Medicine Guide Module – Offers basic symptom-based medicine suggestions.
- Pharmacy Locator – Helps users find nearby trusted pharmacies.

## II. RELEVANT LITERATURE

### *A. Counterfeit Drug Detection System with Multi-Layered Checking*

This study examines the scale of counterfeit medicines and introduces an OCR-based authentication pipeline that inspects printed text and packaging details to estimate drug genuineness. The system focuses on extracting minute textual features from medicine strips and uses them to assess authenticity levels. While the method demonstrates potential in identifying inconsistent or tampered information, its performance depends heavily on image clarity and packaging condition, making it vulnerable to errors when faced with poor lighting, low-quality cameras, or partially damaged labels. The findings highlight the strengths of OCR in counterfeit detection but also reveal the need for more robust, multi-layered verification beyond textual comparison alone.

### *B. Counterfeit Drug Detection System Using Deep Learning*

This study propose a deep-learning approach that analyzes medicine packaging through object detection and OCR to differentiate genuine products from counterfeits. Their model identifies visual elements such as logos and extracts printed information for comparison against verified data, allowing image-based classification using standard mobile cameras. This framework offers a more comprehensive inspection than OCR alone, yet its scope is limited to authenticity checks and does not incorporate additional user-centric features such as medicine guidance or pharmacy support. Moreover, the absence of secure serialization methods such as QR-based batch verification reduces reliability against sophisticated counterfeiting techniques. The work underscores the importance of combining visual analysis with authenticated data sources to strengthen detection accuracy.

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## III. SYSTEM DESIGN AND METHODOLOGY

The proposed methodology combines AI-driven image analysis, OCR-based text extraction, and dataset-level validation to detect counterfeit medicines with high accuracy. Instead of relying on manual inspection, the system performs multi-layer authentication using YOLOv8 for packaging detection, CNN-based pattern recognition, OCR label extraction, and real-time comparison with a verified pharmaceutical dataset. The architecture operates in two key phases Training and Application supported by a Python/Django backend and a responsive web interface. This modular design ensures scalable deployment and easy updates to both the dataset and the underlying models.

### *A. Training Phase*

The training phase builds the intelligence required for verification through the following steps:

1. **Dataset Creation:** Curated images of authentic and counterfeit medicine packages are collected from certified sources and structured datasets.
2. **Preprocessing:** Images are cleaned, normalized, annotated, and prepared to emphasize crucial features like logos, seals, and batch identifiers.
3. **Text Extraction & Cleaning:** OCR is applied to extract label text, which is refined to preserve accurate details such as expiry dates and batch numbers.
4. **Model Training:** YOLOv8 identifies key visual elements, while CNN layers learn packaging patterns, enabling classification into genuine, fake, or suspicious.
5. **Database Integration:** Verified packaging patterns, label embeddings, and batch information are stored in a searchable dataset for efficient real-time matching.

### *B. Application Phase*

The application phase describes how the system operates when a user initiates a verification request.

1. **User Input:** The user scans a QR code or uploads a packaging image through the interface.
2. **Feature Extraction:** The backend runs OCR and CNN/YOLOv8 modules to extract visual and textual features, converting them into embeddings.
3. **Dataset Matching:** Extracted features are compared with the Verified Medicine Dataset for label accuracy, packaging consistency, batch validity, and expiry correctness.
4. **Authentication:** Based on similarity scores and detection results, the system classifies the medicine as genuine, counterfeit, or uncertain.
5. **Output Delivery:** The decision and relevant verification details are returned to the user, completing the evaluation cycle.

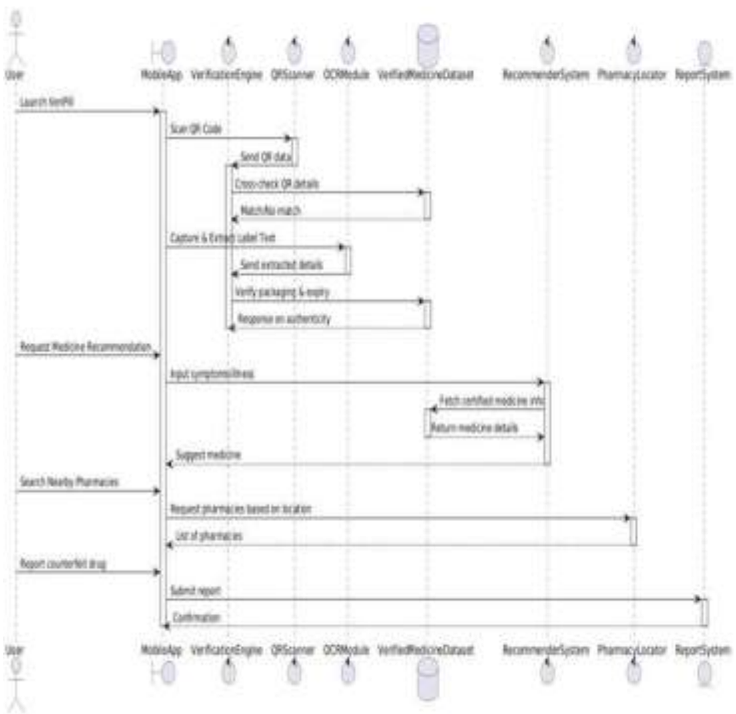


Fig 1. High-Level System Design

 

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## IV. RESULTS AND DISCUSSION

The VeriPill system effectively achieved accurate counterfeit medicine detection through its multi-layer AI verification approach. The combination of YOLOv8 for packaging analysis, CNN-based pattern recognition, and OCR-driven label extraction produced consistent and reliable results during testing. The system successfully identified tampered packaging, incorrect batch details, and label inconsistencies when compared with the verified medicine dataset.

Users found the interface intuitive, and additional features such as medicine guidance and pharmacy locator improved overall usability. The results clearly show that VeriPill reduces dependence on manual inspection and enhances medicine safety by providing fast, automated, and trustworthy authentication.

## V. CONCLUSION AND FUTURE WORK

VeriPill demonstrates that AI-driven packaging analysis and OCR-based label verification can significantly improve the detection of counterfeit medicines. By combining visual inspection, text extraction, and dataset matching, the system delivers quick and reliable authentication that reduces dependence on manual checks.

Future improvements include expanding the verified medicine database, enhancing model accuracy with larger training sets, and integrating live pharmaceutical data sources. Later phases may also explore Raman Spectroscopy or similar optical methods to identify chemical signatures inside tablets, enabling deeper verification beyond packaging. These upgrades will help VeriPill grow into a more precise, scalable, and impactful solution for public medicine safety

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