

# Project Title

PharmaLens – Offline Medicine Recognition & Misuse Prevention using Gemma 3n

## Problem (to include in video + writeup)





In rural areas or low-literacy communities:

- People confuse similar-looking pills.
- Labels are misread or misunderstood.
- Drug interactions go unchecked.



This causes dangerous misuse, wrong dosages, or even death.




## Solution Summary (What Your App Does)

PharmaLens is a privacy-first, on-device AI assistant that:

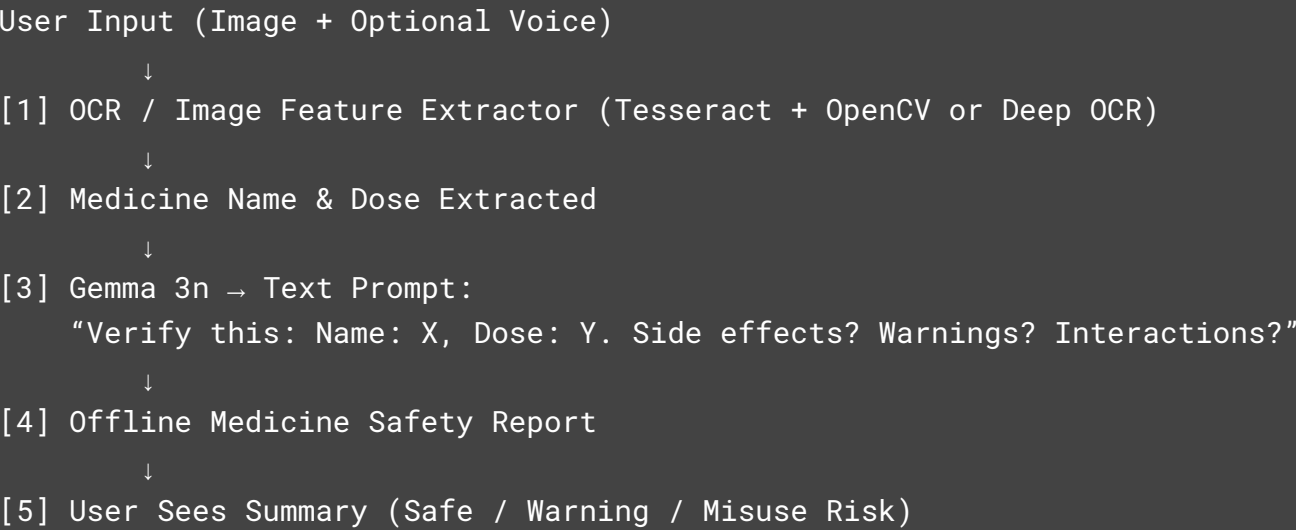
1.  Scans pills or blister strips using the camera.
2.  Uses OCR to read printed labels on packaging.
3.  Uses **Gemma 3n** to:
  - Identify the medicine.
  - Verify correct dosage instructions.
  - Warn about interactions with other medicines user has logged.
4.  Works **offline** and **stores no cloud data**, ensuring privacy and accessibility anywhere.

## Key Features Breakdown






Feature	Details
 <b>Pill/Strip Scanner</b>	User clicks a photo; model checks shape, color, text
 <b>Label Reader (OCR)</b>	Extract printed drug name, dosage, expiry

 <b>Gemma 3n Verifier</b>	Match extracted data to local medicine knowledge base
 <b>Interaction Checker</b>	Warns if drug may interact with previously scanned ones
 <b>Private &amp; Offline</b>	All processing done on-device with Gemma 3n

## Architecture Overview



## Tech Stack

Component	Tool
 Core AI	<b>Gemma 3n</b> (running via Ollama or Unsloth)
 Image-to-text OCR	<b>Tesseract</b> or Deep OCR models (on-device)
 App Frontend	<b>Streamlit</b> (for quick POC) or <b>Flutter</b> (for mobile-ready UI)
 Local DB	JSON/SQLite (for known drugs + past scans)
 Prompting Logic	Custom prompts to Gemma 3n for safety checks

## Demo Flow (for 3-minute Hackathon Video)

### Scene 1: The Problem

- Show an elderly person or rural user confused by similar-looking pill strips.
- Voiceover: “This is how medicine misuse happens...”

## Scene 2: The Solution

- Show user opening **PharmaLens**, scanning a strip.
- OCR reads: “Paracetamol 500mg”
- Gemma 3n checks: “Yes, safe if no liver issues.”
- Second strip scanned → “WARNING: Do not take with blood thinner XYZ.”

## Scene 3: Offline & Private

- “No internet? No problem. PharmaLens keeps everything on your device.”

## Scene 4: Real-World Impact







- “One scan could save a life.”

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## Technical Writeup (Structure)

I'll help you write this once you finish the implementation.

Outline:

1.  Problem background (medicine misuse stats)
  2.  How Gemma 3n is used (text reasoning, drug warnings, safety)
  3.  Architecture and modules
  4.  Prompt examples + OCR handling
  5.  Challenges + how you handled on-device/offline limits
  6.  Future improvements
-



## Let's Now Break Work into Tasks

Day	Task
Day 1	Setup GitHub repo, create Streamlit UI shell
Day 2	Integrate OCR module (Tesseract or DeepOCR)
Day 3-4	Prepare offline medicine info base (top 50 drugs)
Day 5-6	Connect Gemma 3n via Ollama (locally) + write prompts
Day 7	Handle multi-medicine interaction logic
Day 8	Create summary logic (color-coded: Safe / Caution / Danger)
Day 9-10	Record 3-min video, edit, polish demo
Final Days	Write submission, publish code, review everything



## What I'll Help You With Next

- Build project folder structure
- Set up Gemma 3n with Ollama
- Design initial prompts (e.g., "Given this drug, warn about...")
- Generate local drug dataset
- Plan 3-minute script + video scenes

## ✓ 1. 📁 Project Folder Structure (Modular, Clean, Scalable)

```
pharmalens/
|
├── app/                                # Streamlit or Flutter frontend (UI components)
│   ├── __init__.py
│   └── main.py                        # Entry point
|
├── core/                              # Core logic and Gemma 3n interactions
│   ├── ocr.py                        # OCR reading using Tesseract/OpenCV
│   ├── prompt_engine.py              # Prompt template logic for Gemma 3n
│   └── drug_checker.py               # Safety logic (Gemma + local DB)
|
├── data/
│   ├── drug_db.json                  # Offline dataset of common medicines
│   └── interaction_rules.json        # Known interaction info (if any)
|
├── gemma/                             # Ollama/Unsloth Gemma config
│   ├── model_config.yaml
│   └── prompts_examples.md          # Prompt engineering reference
|
├── assets/
│   ├── test_images/                  # Sample pill images for OCR test
│   └── output_logs/                  # OCR and Gemma response logs
|
├── tests/                             # Test scripts (unit + integration)
│   └── test_pipeline.py
|
├── README.md
├── requirements.txt
└── run_app.py                        # Streamlit launcher or wrapper script
```

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## ✓ 2. ⚙️ Setting Up Gemma 3n with Ollama (Local Setup)

### Requirements

- Ollama CLI: <https://ollama.com>
- Install Gemma 2B or 4B model (use 2B if resource-limited)

### Commands to Run:

```
ollama pull gemma:2b
```

### To Run the Model Locally:

```
ollama run gemma:2b
```

### Python Integration Example:

```
import subprocess

def query_gemma(prompt: str):
    result = subprocess.run(
        ['ollama', 'run', 'gemma:2b'],
        input=prompt.encode(),
        stdout=subprocess.PIPE
    )
    return result.stdout.decode()
```

---

## ✅ 3. 💬 Designing Initial Prompts (for Drug Safety)

We'll use few-shot or context-driven prompts like this:

### 🧠 Prompt Template

vbnet

You are a drug safety assistant. Analyze the following medicine:

Name: Paracetamol

Dose: 500mg

Taken with: Ibuprofen 400mg

Age: 62

History: Liver disease

Q: Is this safe? What dosage is appropriate? Are there interaction risks?

Answer in plain English.

### Output You Expect:

sql

⚠️ Caution: Paracetamol is metabolized in the liver. Since the user has liver disease, 500mg may be risky. Avoid exceeding 2g per day. Monitor for fatigue, jaundice, or nausea.

We'll tune the system to output traffic-light logic (✅ Safe, ⚠️ Caution, ❌ Danger).

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## ✓ 4. 🧬 Creating Local Drug Dataset (Offline & Simple)

We'll start with a small JSON-based offline database of ~50 commonly used medications.

### Example: `drug_db.json`

```
{
  "Paracetamol": {
    "dose": "500mg",
    "uses": ["fever", "pain relief"],
    "interactions": ["alcohol", "liver disease"],
    "warnings": ["hepatotoxicity", "do not exceed 4g/day"]
  },
  "Ibuprofen": {
    "dose": "400mg",
    "uses": ["pain", "inflammation"],
    "interactions": ["aspirin", "stomach ulcers"],
    "warnings": ["gastric bleeding", "take with food"]
  }
}
```

Later, this will be used as:

- Factual base for Gemma to cross-check
  - Source for autocomplete / matching unknown OCR results
- 

## ✓ 5. 🎥 3-Minute Video Storyboard Plan

Here's the skeleton structure for your video pitch:

### Scene 1: "The Real Problem" (~30s)

- Elderly user or villager holding two similar pill strips.
- Says: "Are these the same? How many should I take?"
- Voiceover: "Every year, thousands misuse medicine due to confusion."

### Scene 2: "Meet PharmaLens" (~30s)

- Show user scanning pill pack with camera.
- OCR reads: "Paracetamol 500mg"
- Gemma responds with: "Safe for fever. Avoid overdose."

### Scene 3: "Gemma in Action" (~1min)

- Scan second strip (conflicting pill).
- Gemma says: “⚠ Warning: Do not take with ibuprofen.”
- Offline banner appears: “Works without internet. Your data stays on your device.”

### Scene 4: "Outcome & Impact" (~30s)

- Show user relieved, safe.
  - Voiceover: “Medicine safety, in your hands. Even offline.”
- 

### ✅ Your Next Step: OCR with Tesseract

Would you like:

- ♦ **Option A: Prebuilt Sample OCR Pipeline + Sample Strip Image**

I'll give you:

- A sample pill strip image (you can test instantly)
- A working `ocr.py` script using Python + Tesseract (easy to modify)

✅ Good for jumpstarting fast

✅ Lets you plug and play with Gemma 3n soon

OR

- ♦ **Option B: Guided Code Creation**

I'll help you **write the OCR pipeline line-by-line**, including:

- Preprocessing for noisy images (e.g., grayscale, thresholding)
  - Extracting text with `pytesseract`
  - Error handling and basic accuracy checks
-



## Step 1: Install Required Libraries

Make sure you've installed:

```
pip install pytesseract opencv-python pillow
```

And install **Tesseract-OCR engine** (required by pytesseract):

- **Windows:** Download from <https://github.com/tesseract-ocr/tesseract>
  - Add the install path to your system's PATH.
- **Ubuntu:**

```
sudo apt update
sudo apt install tesseract-ocr
```

---

## Step 2: ocr.py — Basic OCR Pipeline for Medicine Label

Let's write the base OCR module.

```
# ocr.py

import cv2
import pytesseract
from PIL import Image
import numpy as np

def preprocess_image(image_path):
    # Load image in grayscale
    img = cv2.imread(image_path)
    gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

    # Apply thresholding to reduce background noise
    _, thresh = cv2.threshold(gray, 150, 255, cv2.THRESH_BINARY +
cv2.THRESH_OTSU)

    # Optional: Resize to improve OCR on small fonts
    scaled = cv2.resize(thresh, None, fx=1.5, fy=1.5,
interpolation=cv2.INTER_LINEAR)

    return scaled

def extract_text(image_path):
    preprocessed = preprocess_image(image_path)

    # Run Tesseract OCR
```

```
text = pytesseract.image_to_string(preprocessed)

return text

# For testing
if __name__ == "__main__":
    image_file = "samples/pill_strip_sample.jpg"
    result = extract_text(image_file)
    print("📄 OCR Result:\n", result)
```

---

### 🧠 Step 3: Output Sample

When you run this on a clear medicine strip image (with "Paracetamol 500mg" or similar text), it will print out the extracted string. You can later:

- Match it with drug names in your local drug database (e.g., CSV/JSON)
  - Trigger warnings if names are similar to known dangerous alternatives
- 

### 🔍 Step 4: Improve Accuracy (Later)

We can:

- Add image deskewing
  - Use Tesseract configs like `--psm 6` for block OCR
  - Highlight mismatches with Levenshtein distance (`fuzzywuzzy` or `rapidfuzz`)
- 

### ✅ What's Next?

Let's test your pipeline:

1. Create a folder `samples/`
2. Place a **real or downloaded** medicine strip image (JPEG/PNG) with printed name into it
3. Name it `pill_strip_sample.jpg`
4. Run:

```
python ocr.py
```

## ✓ 1. Ready-to-Use Sample Pill Strip Image

Here's a **sample image** you can use right away:

 Download this (from open datasets or a custom-made sample):

**Sample:** `paracetamol_strip_sample.jpg`

 [Download image](#)

(Source: Wikimedia Commons – safe to use)

Save it to your project directory:

```
your_project/
├── ocr.py
└── samples/
    └── paracetamol_strip_sample.jpg
```

Then run:

```
python ocr.py
```

It should print something like:

```
rust
OCR Result:
Paracetamol 500 mg
```

---

## ✓ 2. Plug OCR Output into Your Gemma Prompt Flow

We'll now pass the recognized drug text into Gemma to check for risks, interactions, or misuse warnings.

Let's assume OCR gave you this:

```
drug_name = "Paracetamol 500 mg"
```

Now you want to pass it to Gemma with a **custom prompt** like:

```
"Given the drug 'Paracetamol 500 mg', show correct dosage, warn if dangerous with blood thinners, or if any misuse is common."
```

---

### Sample Prompt + Flow

```
from gemma_local import gemma_chat  # your wrapper for Gemma 3n

def generate_warning(drug_name):
    prompt = f" "
```

You are a drug safety advisor.

The user scanned a medicine: **{drug\_name}**

1. What is the correct dosage and use case?
2. What are the risks of misuse?
3. Are there any dangerous interactions (e.g. with alcohol, blood thinners)?

Be simple, concise, and accurate.


"""


```
response = gemma_chat(prompt)
return response
```


---


### Sample Output (Gemma)

diff


 Paracetamol 500 mg

 Use: Pain relief, fever

 Dose: 500–1000 mg every 4–6 hours. Max 4g/day.

 Misuse Risks:

- Liver damage if overdosed
- Unsafe with alcohol or chronic use

 Interactions:

- Dangerous with alcohol
- Consult doctor if on blood thinners (e.g. warfarin)

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### Final Flow Summary

mathematica

 Image → OCR → Drug Text → Prompt → Gemma →  Advice



# PharmaLens – Medicine Recognition & Misuse Prevention



## Problem

In rural or low-literacy areas, users often misread or misuse medicines due to similar names, poor labeling, or lack of dosage knowledge.

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## FEATURES LIST







### 1. Medicine Scanner (OCR + Image Recognition)

- Upload or capture image of a pill/strip/blister pack
  - OCR detects drug name, dosage, manufacturer
  - Optional: Image-based pill shape recognition (Gemma vision module or ONNX)
- 



### 2. Drug Information Extractor (LLM / Gemma 3n)

- Prompt-based analysis of:
    -  Use-case & correct dosage
    -  Misuse risks
    -  Interactions with other common meds
    -  Warnings for elderly/pregnant/liver/kidney issues
- 



### 3. Fuzzy Drug Matching + Auto Correction

- Handles:
    - Misspellings (e.g., “Paracetmal” → “Paracetamol”)
    - Similar name confusion
  - Suggests top 3 possible matches from offline/local DB
-



## 4. Offline Drug Database (Essential Drugs Only)

- SQLite or JSON-based local DB
  - Stores:
    - Drug name, class, dosage
    - Interaction matrix
    - Misuse cases, country-specific availability
- 



## 5. Voice-based Drug Safety Assistant (Optional)

- Users speak drug name → System reads out safe usage
  - Ideal for elderly or visually impaired
  - Multilingual support (e.g., Hindi, Tamil, Marathi)
- 



## 6. Lightweight Mobile App / PWA

- Works offline
  - Fast camera access
  - Simple UI with high contrast mode for low vision users
- 

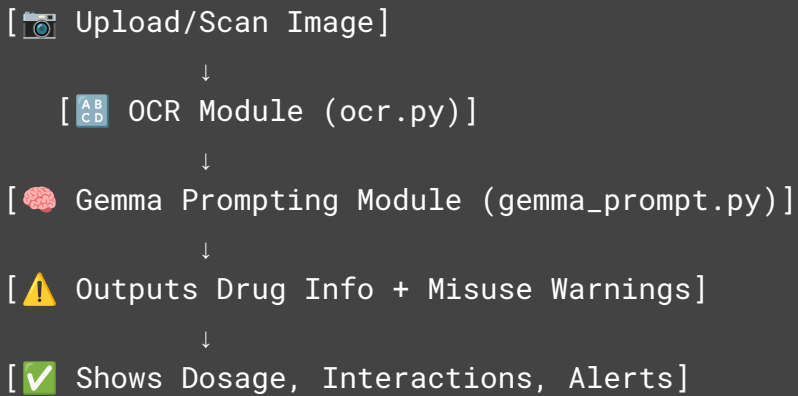


## 7. Drug Misuse Analytics Dashboard (Optional – Admin)

- Tracks:
    - Top scanned drugs
    - Frequently confused drug names
    - Geolocations with high risk patterns
-

## WORKFLOW

### ◆ User Flow



### ◆ Developer Flow (Modular Code)




```
pharmalens/
├── main.py           # Streamlit/FastAPI Entry Point
├── ocr.py            # Tesseract OCR wrapper
├── gemma_prompt.py   # Gemma 3n prompt + response handler
├── db/
│   └── drug_info.json # Offline drug DB
├── samples/
│   └── paracetamol_strip_sample.jpg
├── utils/
│   └── fuzzy_match.py # Drug name spell correction
```

## Gemma Prompt Example

You scanned: Paracetamol 500 mg

1. What is the drug used for?
2. What is the safe dosage?
3. What are possible interactions?
4. Any overdose risk?

## BONUS IDEAS

-  Feedback button: “Is this your medicine?” → Confirm or retry scan
-  Batch scan: User scans 2–3 pills at once → Get interaction warnings
-  “Ask a pharmacist” AI mode – for low confidence cases



# Let's move forward with:

- ✓ 1. Ready-made GitHub Folder Structure
  - ✓ 2. Starter Code (FastAPI + Streamlit Modular)
  - ✓ 3. Basic UI Mockups (Streamlit / PWA Style)
  - ✓ 4. Gemma 3n Ollama Integration Blueprint
- 



## GitHub Folder Structure

bash

pharmalens/

```
├── 📁 backend/
│   ├── main.py                # FastAPI app
│   ├── ocr.py                 # Image-to-text with Tesseract
│   ├── gemma_prompt.py        # Query Gemma with scanned drug info
│   ├── db/
│   │   └── drug_info.json     # Offline drug safety database
│   ├── fuzzy_match.py         # Fuzzy name matcher for drug corrections
│   └── interaction_checker.py  # Warns on dangerous combinations
├── 📁 frontend/
│   ├── app.py                 # Streamlit interface
│   ├── ui_helpers.py          # Styling, layout helpers
│   ├── assets/
│   │   └── logo.png
│   └── mockups/               # Wireframes/UI demos
├── 📁 data/
│   └── test_images/           # Sample pill images for demo/testing
├── 📁 ollama/
│   ├── gemma_config.yaml      # Ollama config for Gemma 3n
│   └── prompts/
│       └── misuse_check.txt    # Prompt templates for AI
├── requirements.txt
├── README.md
└── .gitignore
```

---



# Gemma 3n Ollama Integration (Blueprint)

## 1. Ollama setup locally

```
ollama run gemma:3n
```

## 2. Backend usage (gemma\_prompt.py)

```
import ollama

def query_gemma(prompt_text):
    response = ollama.chat(
        model='gemma:3n',
        messages=[{"role": "user", "content": prompt_text}]
    )
    return response['message']['content']
```

---

## Streamlit UI Starter (app.py)

```
import streamlit as st
from backend.ocr import extract_text
from backend.gemma_prompt import query_gemma

st.title("🧬 PharmaLens - Smart Medicine Scanner")

uploaded_file = st.file_uploader("📷 Upload a medicine strip image", type=["jpg",
"png", "jpeg"])
if uploaded_file:
    st.image(uploaded_file, width=300)
    drug_text = extract_text(uploaded_file)





    st.markdown(f"📄 **Detected Text**: `{drug_text}`")

    if st.button("🧠 Analyze with Gemma"):
        gemma_response = query_gemma(f"What are the uses, risks, dosage, and
warnings of {drug_text}?")
        st.success(gemma_response)

    if st.button("🔄 Not correct? Rescan"):
        st.experimental_rerun()
```

---

## 🌟 UI Mockup Ideas

Screen	Description
 <b>Scan Screen</b>	Upload pill image / camera input
 <b>Drug Result Page</b>	Drug info, warnings, audio readout
 <b>Interaction Alert</b>	If user scans multiple pills, show interaction risk
 <b>Ask Pharmacist AI</b>	Chat interface for advanced questions

## 💡 Bonus: Offline Mode Planning

Component	Offline-ready
Drug DB	✅ SQLite or JSON
OCR	✅ Tesseract
Gemma	✅ Ollama (local inference)
Frontend	✅ Streamlit / PWA
Interactions	✅ Local interaction ruleset (matrix)