



## VYAAAN AI-AI ASSITANT FOR X-RAY DIAGNOSIS AND REPORTING

### PROBLEM STATEMENT

Radiologists are in short supply in India, especially in rural regions, leading to delayed or missed diagnosis of critical diseases such as **tuberculosis (TB)**, **pneumonia**, and **lung cancer**. Chest X-rays, although readily available, are underutilized due to the lack of skilled professionals to interpret them in real time. As a result, preventable deaths and late-stage disease progression remain widespread.

India carries one of the world's highest burdens of TB and respiratory illnesses. In rural and low-resource areas, patients often face delays of days or weeks for diagnosis because of insufficient radiological expertise. The current diagnostic process is slow, relies heavily on human interpretation, and cannot scale to meet demand. By using AI to interpret X-rays and generate medical reports in **multiple Indian languages**, we can bridge the accessibility gap, speed up diagnosis, and enable **early intervention**, ultimately saving lives and improving healthcare delivery.

### Target Audience

- **Rural health centers & PHCs** lacking in-house radiologists
- **District hospitals & TB clinics** involved in respiratory disease surveillance
- **Government health missions** (e.g., Ayushman Bharat) for public diagnostics
- **Doctors & radiologists** in need of second-opinion support
- **Patients** seeking simplified understanding of reports

### AI APPLICATION

- **Auto-generate medical reports** from X-ray disease predictions
- **Explain diagnoses in patient-friendly language**
- **Translate reports into regional languages** like Hindi, Odia, and Bengali
- **Enable voice-based patient explanations**

### WORKFLOW

#### 1. Upload Image

Healthcare workers upload chest X-rays through a web or mobile interface.

#### 2. Preprocessing

The system normalizes and resizes the image to 224×224 pixels, with optional contrast enhancement.

#### 3. Disease Detection

A pre-trained convolutional neural network (DenseNet121) analyzes the image to detect:

- Tuberculosis
- Pneumonia
- Lung cancer

Datasets: NIH ChestX-ray14, RSNA, Montgomery TB, etc.

#### 4. Visual Interpretability

Using **Grad-CAM**, the system highlights key image regions that influence its diagnosis, providing transparent visual evidence for verification.

## 5. Gen-AI Medical Report

An advanced language model generates two versions:

- A detailed medical report for healthcare professionals
- A clear, simple explanation for patients

## 6. Translation

The system translates reports into local languages through specialized Indian language models and translation services.

## 7. Deployment

The application is optimized using TensorFlow Lite for use on:

- Mobile phones
- Tablets
- Low-end laptops in rural clinics

## SOLUTIONS USED

Step	Task	Tools/Models Used
1. Upload X-ray	Web/mobile interface for doctors or health workers to upload X-ray image	HTML, Streamlit/Flask
2. Preprocessing	Resize (224x224), normalize, contrast enhancement (CLAHE)	OpenCV, PIL
3. Disease Detection	Multi-label classification for TB, Pneumonia, Lung Cancer	DenseNet121 / ResNet50, PyTorch/TensorFlow
4. Interpretability	Grad-CAM heatmaps for visual explanation of model decisions	tf-keras-vis / Captum
5. Gen-AI Report	LLM generates structured report based on detected conditions	GPT-3.5 / Gemma / LLaMA
6. Translation	Translate reports to local languages for patients	IndicBART, Google Translate, Bhashini
7. Patient Summary	Simplified explanation in regional languages with medical advice	Prompted LLM
8. Deployment	Optimized models for mobile or offline environments	TF Lite / ONNX / Hugging Face Spaces

## IMPACT

Metric	Impact
⌚ Diagnosis Time	Reduced from 1–3 days to under 10 seconds
📍 Access to Diagnostics	Even in rural clinics without radiologists
📊 AI Trust	Visual explanation (heatmaps) builds transparency
🌐 Language Accessibility	Regional languages and simple summaries
📞 Clinical Support	Helps overworked doctors, especially in remote or crisis areas
💡 Scalability	Usable by NGOs, government, or private hospitals nationwide

## Business Idea

Revenue Model:

- **B2B** Licensing to:
  - Telemedicine startups
  - Government TB screening programs
  - Rural hospitals & diagnostic chains
- **B2G** partnerships for Ayushman Bharat & Health Missions
- **Pay-per-report API** for startups needing diagnosis + reporting
- **Freemium model** for NGOs: Free report generation with watermark, paid for detailed analytics

Scaling Plan:

- Pilot with 3 rural districts via NGO + government health schemes
- Partner with TB detection drives (e.g., Nikshay portal)
- Integrate with health kiosk startups and public health clinics

Future Expansion:

- Add Breast Cancer (Mammography)
- Expand to MRI/CT scan support
- Integrate with WhatsApp/IVR for rural patients with no smartphones

## WHY OUR SOLUTION IS UNIQUE

- Combines **CNN-based image detection** with **LLM-based generative text**
- Targets **low-resource real-world deployment** using model compression
- Supports **multi-lingual reporting** for regional inclusiveness
- Designed for **edge-first, offline-capable AI diagnosis**