

# SightGuardian AI

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## 1. The Problem: Why This Matters

India is witnessing a growing crisis of preventable blindness, primarily due to **diabetic retinopathy, cataracts, and corneal diseases**. This problem is aggravated by the shortage of ophthalmologists and diagnostic infrastructure, especially in rural and underserved regions. Early intervention is often the key to preserving sight, yet delayed diagnoses are common. We aim to address this gap by proposing "**SightGuardian AI**" — a user-friendly AI-powered solution that can assist in early screening, support timely treatment, and reduce avoidable blindness.

## 2. Who We Aim to Help

Our solution targets community health workers, local diagnostic labs, and semi-urban or rural clinics that lack specialist access. It also considers patients in remote areas who have limited exposure to eye-care awareness or facilities. By creating a **low-cost, intelligent and user-friendly screening tool**, we aim to enable early detection where it's needed the most.

## 3. Role of Generative AI in Our Approach

We propose using pre-trained **computer vision models** from Hugging Face to identify signs of diabetic retinopathy, cataracts, or keratopathy from retinal images. The output will be sent to a **RAG (Retrieval-Augmented Generation)** model trained on past diagnostic reports and relevant sources. **LangChain** will handle the **Retrieval** and **Large Language Models** like GPT-4 or Gemini will do the **Generator** part. Visual aids like **Grad-CAM** highlight critical image regions, while models like **BLIP** can assist in generating context-aware image captions, improving clinical transparency and interpretability.

## 4. Solution Framework and Workflow

SightGuardian AI operates through the following framework designed for scalability and accessibility:

- **Image Upload & Preprocessing:** Users upload retinal images via a mobile or web interface, with enhancements like contrast adjustment and denoising to ensure image quality.
- **AI-Powered Condition Detection:** Pre-trained models (EfficientNetB0, ResNet50, ViT) analyze images for signs of diabetic retinopathy, cataracts, and keratopathy. Visual aids like Grad-CAM and BLIP enhance transparency.
- **Intelligent Report Generation:** A RAG+LLM model creates readable summaries with severity, treatment suggestions, and preventive steps.

- **Advanced Clinical Guidance:** For complex cases, it provides surgical readiness checklists and referral cues.
- **Delivery & Integration:** Reports with visuals and recommendations are shared through the app for immediate action.

## 5. Feasibility and Execution Plan

We will utilize publicly available datasets such as **APTOS 2019**, **EyePACS**, and **Messidor** to evaluate the performance of pre-trained computer vision models hosted on Hugging Face. These models minimize retraining efforts and ensure rapid prototyping. For the **backend**, we will use **FastAPI** integrated with **LangChain** to connect CV outputs to a **RAG** system trained on diagnostic data. GPT-4 or Gemini will then generate reports dynamically. The frontend, built in **React.js**, will support image uploads and intuitive result presentation. Cloud deployment ensures accessibility, scalability, and continuous iteration.

## 6. Scalability and Potential Impact

SightGuardian AI is built for scalable deployment across India's diverse healthcare ecosystem. Its cloud-based infrastructure ensures it runs smoothly on both mobile and desktop devices, making it adaptable for **rural clinics**, **urban hospitals**, and **telemedicine networks**. Through partnerships with **local clinics**, **digital health startups**, and **eye care NGOs**, the platform can reach underserved populations quickly. Its AI-generated reports empower frontline health workers to make timely, informed referrals. In the long term, expert-driven updates and integration of new clinical data will keep the system current and improve decision-making. Feedback loops from users will guide iterative improvements, ensuring accuracy, safety, and local relevance.

## 7. Summary and Vision Forward

SightGuardian AI offers a practical and accessible approach to early eye disease detection using a **blend of computer vision and language models**. Its user-friendly interface, and low-resource compatibility make it ideal for use across India's healthcare settings. By focusing on assistive, explainable AI, it simplifies clinical decision-making for frontline workers and expands reach to populations often left out of traditional systems. Its design emphasizes real-world usability and adaptability, making it a valuable, scalable solution that supports national goals in vision care and public health.

**"With SightGuardian AI, we envision a future where no one loses vision simply because help came too late."**

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