A

Mini Project Report on

Disease Prediction Using Retinal Scans

Submitted in partial fulfilment of the requirements
for the degree of
BACHELOR OF ENGINEERING
IN
Computer Science & Engineering
Artificial Intelligence & Machine Learning

by

Prajwal Dhanawade (24206007)
Gaurav Kshirsagar (24206009)
Shitanshu Yadav (23106081)
Achal Pandey (23106064)

Under the guidance of
Prof. Poonam Tiware

Department of Computer Science & Engineering
(Artificial Intelligence & Machine Learning)
A. P. Shah Institute of Technology
G. B. Road, Kasarvadavali, Thane (W)-400615
University Of Mumbai

2025-2026

A. P. SHAH INSTITUTE OF TECHNOLOGY

CERTIFICATE

This is to certify that the project entitled "**Disease Prediction Using Retinal Scans"** is a bona fide work of Prajwal Dhanawade (24206007), Gaurav Kshirsagar (24206009), Shitanshu Yadav (23106081),Aachal Pandey (23106064) submitted to the University of Mumbai in partial fulfillment of the requirement for the award of **Bachelor of Engineering** in **Computer Science & Engineering (Artificial Intelligence & Machine Learning).**

Prof. Poonam Tiware	Dr. Jaya Gupta
Mini Project Guide	Head of Department

A. P. SHAH INSTITUTE OF TECHNOLOGY

Project Report Approval

This Mini project report entitled "**Disease Prediction Using Retinal Scans**" by **Prajwal Dhanawade, Gaurav Kshirsagar, Shitanshu Yadav and Aachal Pandey** is approved for the degree of ***Bachelor of Engineering*** in ***Computer Science &Engineering***, **(AIML)** ***2024-25***.

External Examiner: ________________

Internal Examiner: ________________

Place: APSIT, Thane

Date:

Declaration

We declare that this written submission represents my ideas in my own words and whereothers' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Prajwal Dhanawade	Gaurav Kshirsagar	Shitanshu Yadav	Aachal Pandey
(24206007)	(24206009)	(23106081)	(23106064)

ABSTRACT

AI-Powered Eye Disease Detection Web Application

In modern healthcare, early detection of eye diseases is crucial to prevent vision loss, yet traditional diagnostic methods are costly and require expert intervention. This project introduces a web-based application that leverages Artificial Intelligence to analyse eye images and provide preliminary diagnosis of conditions such as diabetic retinopathy, glaucoma, and cataract. By applying deep learning models, the system offers a quick, affordable, and accessible diagnostic aid, especially for users in remote or underserved regions.

The project is developed using Python for backend integration, and deep learning frameworks like TensorFlow/Keras for model training and deployment. The system addresses challenges such as limited access to ophthalmologists, high consultation costs, and the time-consuming nature of manual screenings. By transforming a simple eye image into an AI-driven diagnosis, the application empowers individuals to take proactive steps toward eye health, making preventive care more efficient and widely available.

Keywords: Eye disease detection, Deep learning, Medical image analysis, Accessible healthcare.

INDEX

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

The rising prevalence of eye diseases such as diabetic retinopathy, glaucoma, and cataract poses a serious global health challenge, as delayed diagnosis often results in irreversible vision loss. The AI-powered Eye Disease Detection Web Application is designed to assist individuals by analyzing eye images and providing early diagnosis, reducing dependency on costly equipment and specialist consultations. By leveraging deep learning models, this tool simplifies the process of screening, making healthcare more accessible, efficient, and affordable.

The purpose of this project is to provide users with an automated solution for detecting eye conditions from simple image uploads. As healthcare technologies continue to evolve, this system enables timely intervention by generating accurate predictions in seconds. Unlike traditional methods, which require in-person clinical visits and advanced diagnostic tools, this AI-powered approach ensures an effortless and reliable way of identifying potential risks.

This system stands out by offering features beyond basic image analysis, including AI-driven classification, probability-based predictions, and a user-friendly web interface. It is particularly beneficial for individuals in underserved or rural areas who may face challenges in accessing ophthalmologists, ensuring that eye healthcare becomes more inclusive and widely available.

In addition to automated diagnosis, the application provides valuable functionalities such as real-time processing, secure image handling, and intuitive design, making it suitable for users of all backgrounds. By simply uploading an eye image, individuals can receive an AI-powered assessment, enabling them to seek medical advice proactively. Whether the goal is preventive care, early intervention, or improved accessibility, this system ensures an optimized healthcare experience.

CHAPTER 2

LITERATURE SURVEY

2. LITERATURE SURVEY

2.1-HISTORY

The evolution of automated eye disease detection has been closely tied to advancements in medical imaging, artificial intelligence (AI), and deep learning. Traditionally, eye diagnosis relied on manual examination by ophthalmologists using specialized equipment such as slit lamps and fundus cameras, which, while effective, were time-consuming and often inaccessible in rural or underserved areas.

In the early 2000s, computer-aided diagnosis (CAD) systems emerged, applying image processing and traditional machine learning techniques like Support Vector Machines (SVM) and k-Nearest Neighbors (k-NN) to analyze retinal images. Although these methods showed potential, they struggled with scalability, limited accuracy, and heavy dependence on handcrafted features, restricting their adoption in real-world healthcare.

With the rapid growth of deep learning in the 2010s, convolutional neural networks (CNNs) began revolutionizing medical image analysis. Research studies demonstrated CNNs' ability to automatically extract complex features from retinal images, significantly improving detection rates for conditions such as diabetic retinopathy and glaucoma. Landmark projects like Google's DeepMind in 2016 highlighted the potential of AI to match or even surpass human-level performance in ophthalmology.

Parallel advancements in cloud computing, open-source frameworks, and availability of public datasets further accelerated development. Competitions on platforms like Kaggle encouraged innovation in retinal disease detection, making AI-driven healthcare more practical and accessible.

In recent years, web and mobile-based diagnostic tools have emerged, integrating AI with user-friendly platforms to provide real-time predictions. By combining modern deep learning architectures, transfer learning, and large-scale image datasets, these systems have moved from research prototypes to deployable solutions. Today, AI-powered eye disease detection is increasingly seen as a valuable tool for early screening, preventive care, and expanding healthcare access worldwide.

2.2-LITERATURE REVIEW

Diabetic Retinopathy Screening Using Machine Learning [BMC Biomed. Eng., 2025]

This review paper explores the rapidly advancing field of artificial intelligence (AI)-driven approaches for diabetic retinopathy (DR) detection, a domain of critical importance given DR's role as one of the leading causes of blindness worldwide. The paper begins with an overview of the clinical burden of DR and highlights the limitations of manual screening, emphasizing the growing demand for machine learning (ML) and deep learning (DL)-based automation. It then systematically examines widely used retinal image datasets and preprocessing strategies that underpin modern AI systems, providing a foundation for further analysis. Subsequent sections review state-of-the-art ML and DL models, focusing on their applications in DR classification, lesion segmentation, and disease grading. The discussion also integrates evaluation of performance metrics, while highlighting persistent challenges such as dataset variability, model interpretability, computational requirements, and scalability in clinical practice. Finally, the paper identifies future directions to enhance DR screening efficiency, aiming to accelerate the development of robust, accessible, and clinically applicable AI solutions. This review thus provides a comprehensive perspective on how AI can transform DR detection, ultimately contributing to earlier diagnosis and improved patient outcomes.

Artificial Intelligence in Age-Related Macular Degeneration [BMC Ophthalmol., 2024]

This review paper investigates the expanding role of artificial intelligence (AI) in the management of age-related macular degeneration (AMD), a leading cause of vision loss globally. The paper begins by outlining the clinical challenges associated with AMD, emphasizing the need for earlier diagnosis and more precise treatment strategies. It then explores how deep learning models have demonstrated the ability to accurately diagnose AMD from retinal imaging and even predict short-term outcomes such as macular fluid exudation and visual acuity (VA) response to therapy. Further, the review examines AI-driven approaches that support treatment optimization, particularly in personalizing anti-VEGF therapy regimens and forecasting long-term disease progression. Notably, studies leveraging novel deep learning biomarkers to predict conversion to geographic atrophy (GA) within 12 months are highlighted as a major advance. The discussion also reflects on the potential of AI to improve patient compliance and clinical outcomes by anticipating disease trajectories at an individualized level. Ultimately, this work underscores the transformative potential of AI in AMD screening, monitoring, and personalized care, paving the way for more proactive and efficient ophthalmic management.

Deep Learning for Medical Image Analysis [Comput. Math. Methods Med., 2023]

This review paper provides a broad survey of deep learning (DL) applications in medical image analysis, emphasizing its transformative impact on healthcare. The paper begins by highlighting how DL has fundamentally reshaped the field, enabling significant improvements in core imaging tasks such as registration, segmentation, feature extraction, and classification. It then examines widely adopted approaches, including convolutional neural network (CNN) architectures, transfer learning with pretrained models, and the use of generative adversarial networks (GANs) to enhance training efficiency and data augmentation. The review further presents performance benchmarks of DL-based systems across diverse clinical domains, ranging from COVID-19 detection to pediatric bone age assessment, showcasing the versatility and robustness of these methods. Additionally, the authors emphasize the role of DL in uncovering subtle and complex patterns in medical images, particularly in specialties such as ophthalmology, where accurate pattern recognition directly informs diagnosis and treatment planning. Ultimately, this work demonstrates how DL-driven medical image analysis continues to evolve as a critical tool for advancing precision medicine and improving clinical decision-making.

Summary of literature review in tabular form:

Authors	Paper Title	Summary	Research Gap
Dejene et al (2025)	AI-Based Screening of Diabetic Retinopathy: A Review	This review explores the use of ML and DL methods for diabetic retinopathy (DR) screening, covering image preprocessing, model architectures, and classification/grading strategies. It highlights public datasets, lesion segmentation, and diagnostic accuracy	Current models face challenges with data imbalance, real-world deployment, and generalization across diverse patient demographics and imaging conditions.
Crincoli et al. (2024)	Artificial Intelligence in Age-Related Macular Degeneration	This paper reviews AI applications in AMD detection and monitoring. It focuses on DL-based diagnostic models, treatment prediction tools (e.g., anti-VEGF response forecasting), and DL biomarkers used to anticipate progression to geographic atrophy.	There is a lack of large-scale, longitudinal datasets and limited validation of AI tools in real-time clinical decision-making settings for AMD treatment planning.
Sistaninejhad et al. (2023)	Deep Learning for Medical Image Analysis	A broad review of DL applications across medical imaging tasks, including segmentation, classification, and anomaly detection. The paper discusses CNNs, transfer learning, and GANs, and evaluates DL performance in areas like COVID-19 diagnosis and ophthalmology.	Despite high performance, deployment is limited due to interpretability issues, limited annotated datasets, and the need for regulatory validation and clinical acceptance..

CHAPTER 3

PROBLEM STATEMENT

3. PROBLEM STATEMENT

The increasing prevalence of eye diseases such as diabetic retinopathy, glaucoma, and age-related macular degeneration poses a major public health challenge, as early detection is crucial to preventing vision loss. Traditional diagnostic methods rely heavily on manual examination of retinal images by specialists, which is both time-consuming and resource-intensive. In regions with limited access to ophthalmologists, patients often experience delayed diagnosis, leading to irreversible damage and reduced quality of life.

Moreover, accessibility remains a pressing concern, as many individuals lack timely screening opportunities due to geographic, financial, or resource constraints. Existing diagnostic approaches are often fragmented, requiring multiple tests and follow-ups, which discourages patient compliance. Manual interpretation is also subject to variability between clinicians, increasing the risk of misdiagnosis and inconsistent treatment recommendations.

Therefore, there is a critical need for an AI-powered system that can automatically analyze eye images and provide reliable, early-stage disease detection. Such a system would support healthcare professionals by delivering consistent, accurate, and rapid results, while also extending access to underserved populations. By leveraging advanced machine learning and deep learning models, this solution would improve efficiency, reduce diagnostic errors, and enable proactive interventions, ultimately helping to preserve vision and enhance patient outcomes.

CHAPTER 4

EXPERIMENTAL SETUP

4. EXPERIMENTAL SETUP

This project is a web-based application designed to automate the detection of ocular diseases from retinal images using advanced deep learning models and image processing techniques. It leverages multiple frameworks, tools, and GPU-accelerated computing resources to ensure accuracy, efficiency, and a smooth user experience.

4.1 Hardware Setup

- **Platform:** Kaggle Notebooks with cloud GPU support.
- **GPU:** NVIDIA T4 ×2 (CUDA-enabled, optimized for deep learning training and inference).
- **Processor:** Cloud-hosted environment with multi-core CPU for pre-processing and parallel operations.
- **RAM:** 16GB (sufficient for handling large image datasets and model training).
- **Storage:** 20GB allocated for dataset storage, pre-processing outputs, and trained models.

4.2 Software Setup

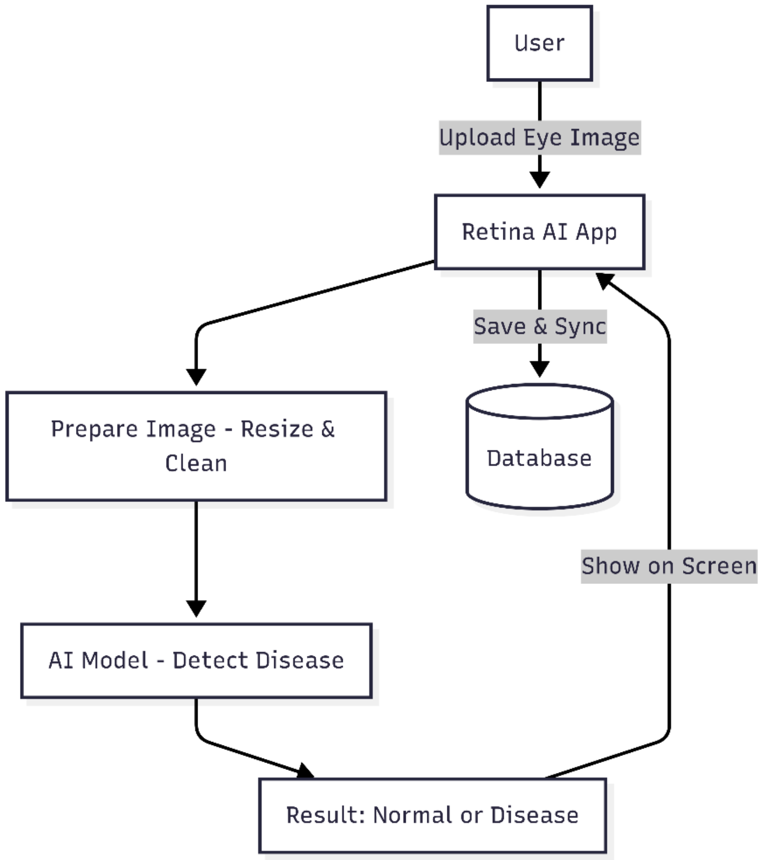
- **Operating System:** Kaggle cloud environment (Linux-based backend).
- **Programming Language:** Python 3.10 or higher.
- **Required Libraries:**
  a) TensorFlow / Keras – For deep learning model implementation and training.
  b) OpenCV – For image preprocessing and augmentation.
  c) NumPy, Pandas – For dataset handling, numerical operations, and tabular analysis**.**
- **Models Used:**
  a) ResNet50 – For robust image classification.
  b) EfficientNetB3 – For optimized accuracy and efficiency in medical imaging.
- **Dataset:** ODIR-5K (Ocular Disease Recognition Dataset) – a benchmark dataset for retinal disease classification.
- **Development Environment**: Kaggle Notebook IDE with GPU runtime enabled for training and testing models.
- **Browser:** Google Chrome – for testing model outputs, notebook execution, and visualization.

CHAPTER 5
PROPOSED SYSTEM
&
IMPLEMENTATION

5. PROPOSED SYSTEM & IMPLEMENTATION

This block diagram outlines the workflow of the project, showing the key components and their interactions.

5.1 DIAGRAMS OF PROPOSED SYSTEM



5.2 DESCRIPTION OF DIAGRAMS.

- **User**
  - The process begins with the user interacting with the Retina AI App.
  - The user uploads an eye image (retinal image) as input for disease detection.

- **Upload Eye Image**
  - Once uploaded, the image enters the application workflow for processing.
  - This serves as the primary input for subsequent analysis..

- **Retina AI App**
  - The uploaded image is handled by the Retina AI App, which manages preprocessing, database storage, and AI-based diagnosis.
  - It also ensures synchronization with the database for secure storage and later retrieval.

- **Database**
  - The uploaded image and diagnostic results are stored in the database.
  - The database also enables synchronization for real-time access and provides data to be shown on screen.

- **Prepare Image – Resize & Clean**
  - The uploaded eye image is preprocessed using image enhancement techniques.
  - Operations include resizing, noise reduction, and cleaning to improve model accuracy..

- **AI Model – Detect Disease**
  - The cleaned and resized image is passed into trained AI models (ResNet50, EfficientNetB3).
  - The model performs classification to determine whether the image shows a normal eye or signs of ocular disease.

- **Show on Screen**
  - Diagnostic results are presented interactively on the application interface.
  - o This allows the user to immediately view the status of their eye health.

Overall, the diagrams illustrate the hierarchical structure of user access, the basic data flow within the system & the overall structure of the database

5.3 IMPLEMENTATION

Implementation of proposed system is included here as screenshots:

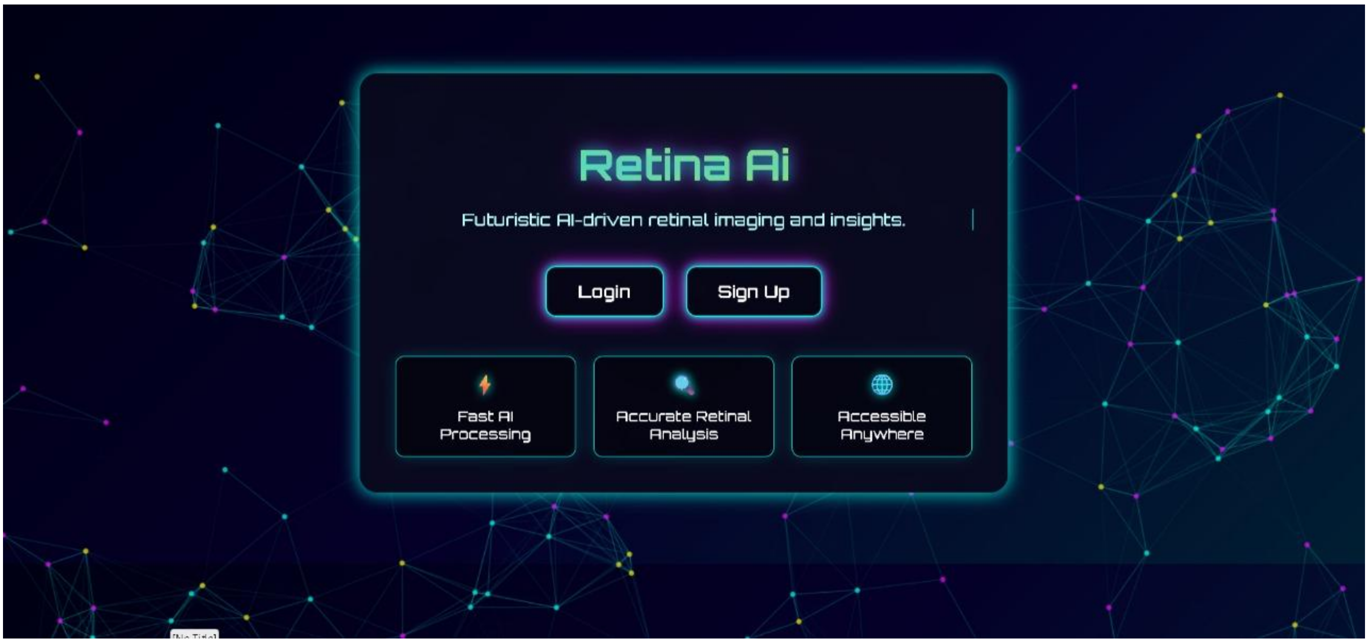


Figure 1: Main page

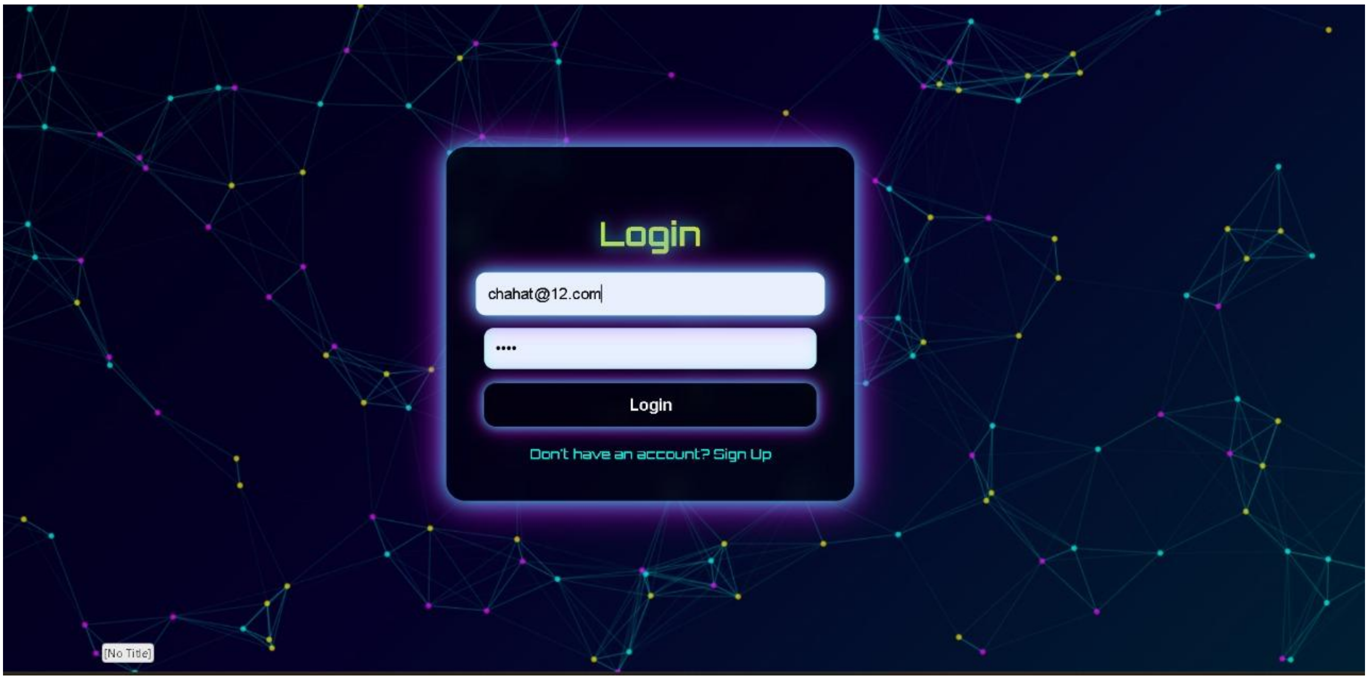


Figure 2: Login page

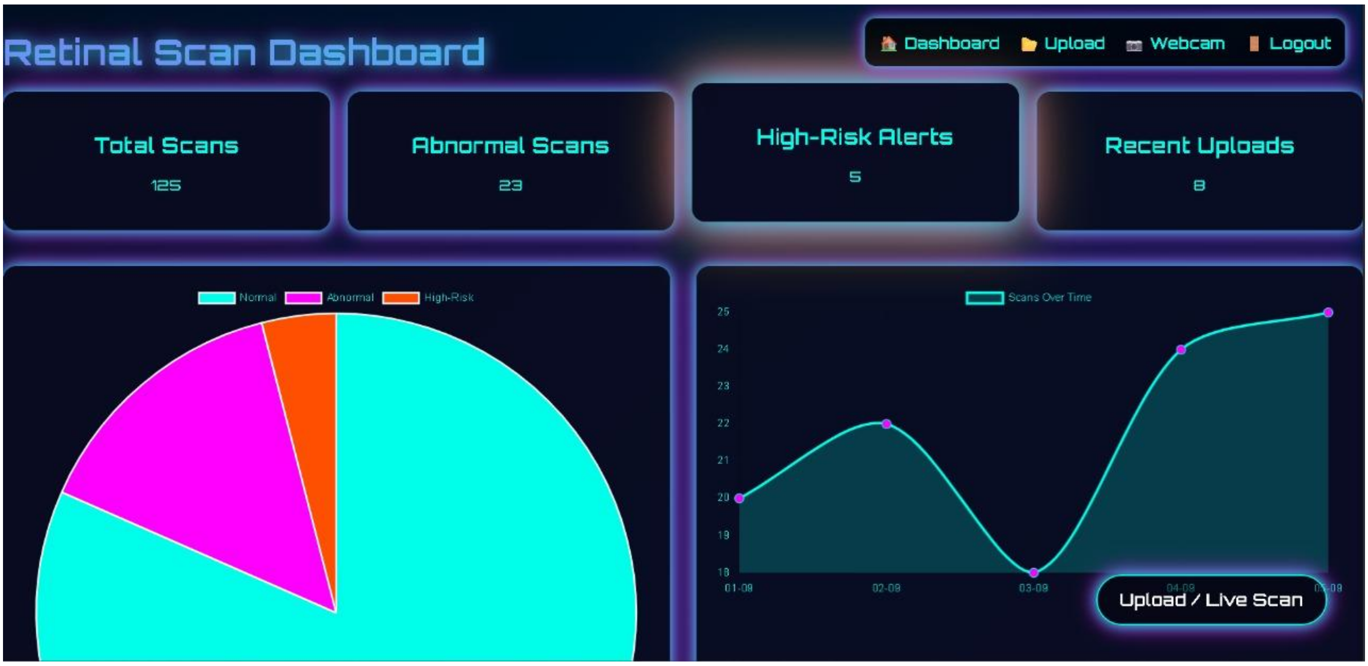


Figure 3: Dashborad Page

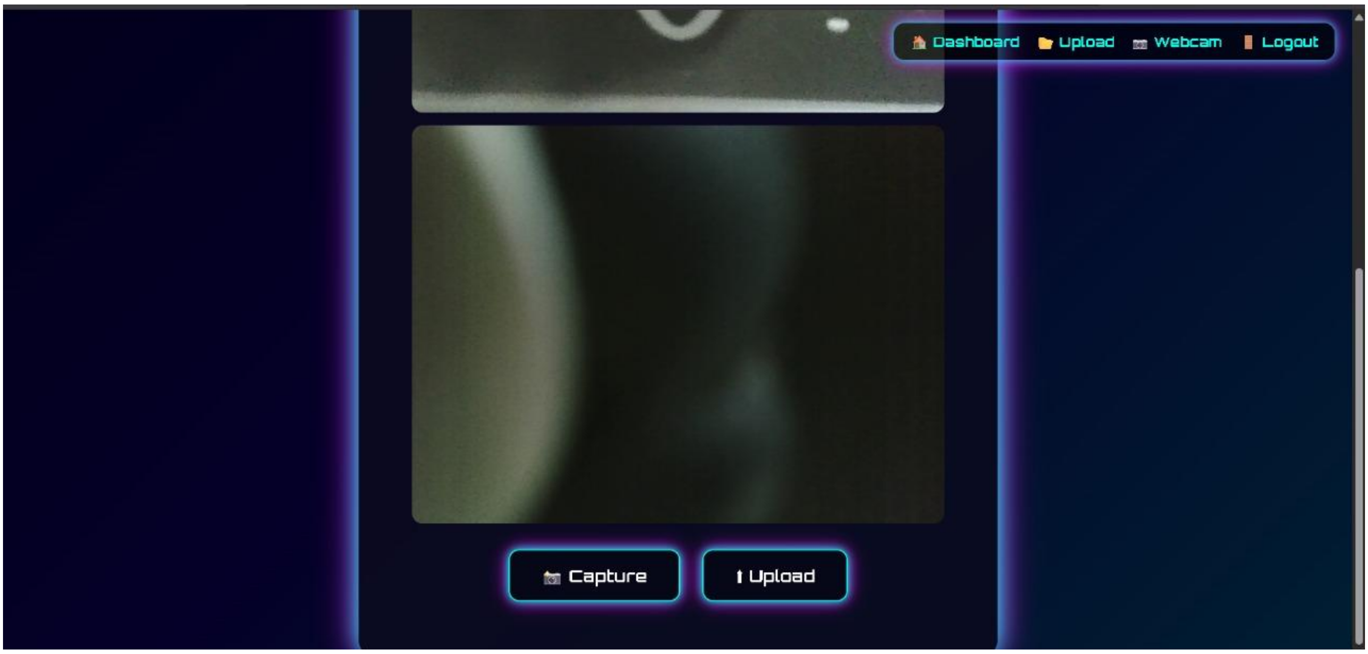


Figure 4: Web Cam Capture