

## AI-Powered Portable Eye Screening Device – An Innovation

<sup>1</sup>Dr. Goutam Datta,<sup>2</sup>Pallabita Datta

<sup>1</sup> Professor; Department of Optometry; Haldia Institute of Management; (Unit of ICARE); Haldia, West Bengal;

<sup>2</sup>Department of Computer Science and Technology; Brainware University; Kolkata, West Bengal

[gdatta53@rediffmail.com](mailto:gdatta53@rediffmail.com)

### Abstract:

Conventional ophthalmic diagnostic devices are often bulky, expensive, and require dedicated installation and trained operators. Portable alternatives may lack integrated functionality, consistent alignment mechanisms, or ergonomic operation. The present design addresses these limitations through a compact, integrated, and user-friendly handheld configuration. This AI-integrated ophthalmic diagnostic devices have brought about a revolutionary shift in eye care. By combining high-resolution imaging techniques with deep learning algorithms, these devices enable the automated screening and detection of conditions like diabetic retinopathy and glaucoma within seconds. The design comprises a compact handheld ophthalmic diagnostic device incorporating an integrated optical module, a viewing cavity for eye alignment, a display section, and a simplified control interface. The arrangement of these elements provides a portable and efficient platform for ocular examination and diagnostic applications.

**Keyword:** *AI-integrated; compact handheld; ophthalmic diagnostic device; handheld configuration;*

### Introduction:

AI-integrated ophthalmic diagnostic devices have brought about a revolutionary shift in eye care. By combining high-resolution imaging techniques with deep learning algorithms, these devices enable the automated screening and detection of conditions like diabetic retinopathy and glaucoma within seconds—right at the point of care—thereby significantly enhancing workflow efficiency and the rate of timely treatment.

An AI-integrated ophthalmic diagnostic device is a groundbreaking technology that combines high-resolution eye images with deep learning algorithms. It instantly analyzes scans, detects subtle structural abnormalities, and provides automated diagnostic support to facilitate eye care.

Present innovation detected and screened different eye conditions; like Diabetic Retinopathy (DR): that rapidly screening enables the immediate detection of microaneurysms and hemorrhages. Glaucoma: that assessed by measuring the cup-to-disc ratio of the optic nerve head. Age-related Macular Degeneration (AMD): which precisely identifies drusen deposits and sub-retinal fluid at an early stage. Retinopathy of Prematurity (ROP): this implemented using portable cameras to screen premature infants in remote areas.

### Field of the invention

The present invention relates generally to ophthalmic diagnostic instruments, and more particularly to a compact, handheld device for ocular examination and screening, configured for ease of use, portability, and integrated optical sensing. The design relates to ophthalmic diagnostic equipment, particularly a handheld device for ocular examination, screening, imaging, and optical sensing applications.

### Background of the invention

Ophthalmic diagnostic instruments are widely used for the detection and monitoring of eye related conditions. Conventional devices such as slit lamps, fundus cameras, and ophthalmoscopes are often bulky, expensive, and require trained personnel for operation. These limitations restrict their accessibility, especially in low-resource and remote environments. Existing portable devices are typically limited in functionality, require multiple attachments, or lack integrated optical configurations that ensure consistent alignment and accurate data acquisition. Furthermore, many current systems are not ergonomically optimized for single-hand operation and may involve complex user interfaces. Accordingly, there exists a need for a compact, integrated

ophthalmic diagnostic device that combines multiple functionalities within a single handheld unit, while maintaining simplicity of use, structural efficiency, and improved accessibility.

Actually, conventional ophthalmic diagnostic devices are often bulky, expensive, and require dedicated installation and trained operators. Portable alternatives may lack integrated functionality, consistent alignment mechanisms, or ergonomic operation. The present design addresses these limitations through a compact, integrated, and user-friendly handheld configuration.

### **Objects of the invention**

The primary object of the present invention is to provide a handheld ophthalmic diagnostic device with an integrated optical configuration. Another object of the invention is to provide a compact and ergonomically designed device suitable for single-hand operation. A further object is to provide a device with a simplified control interface to enhance usability. Another object is to ensure stable eye alignment and consistent positioning during examination. A further object is to provide a structurally integrated device that minimizes the need for external attachments.

### **Summary of the invention**

The present invention discloses a handheld ophthalmic diagnostic device comprising a compact housing with an integrated multi-aperture optical module, a recessed viewing cavity, and a minimal control interface. The optical module is arranged in a symmetrical geometric configuration to facilitate multi-modal imaging and sensing. The device is configured to enable stable alignment with the eye, while maintaining a streamlined structure suitable for portable use. The recessed cavity enhances positioning accuracy, and the simplified control interface allows intuitive operation. The invention integrates optical sensing, alignment features, and control mechanisms into a unified form, thereby improving usability and accessibility compared to conventional systems.

Therefore, the design comprises a compact handheld ophthalmic diagnostic device incorporating an integrated optical module, a viewing cavity for eye alignment, a display section, and a simplified control interface. The arrangement of these elements provides a portable and efficient platform for ocular examination and diagnostic applications.

### **Overall Design Configuration**

The design consists of a compact, handheld ophthalmic diagnostic instrument with a vertically oriented, ergonomically contoured body. The front view emphasizes a unified and symmetrical appearance with smooth edges and a clean surface profile, ensuring ease of handling and visual distinctiveness.

### **Front View Features**

The upper region incorporates a prominently enlarged multi-aperture optical module arranged in a precise geometric configuration, forming the primary visual and functional focal point. Beneath this, a recessed optical cavity is centrally aligned to facilitate accurate eye positioning and stable alignment during examination. A single, centrally accessible rotary control interface is integrated on the front surface, maintaining minimalism while enabling intuitive operation.

### **Functional Characteristics**

The front-facing configuration is designed to support integrated optical sensing and imaging, allowing efficient acquisition of ophthalmic data. The enlarged optical module enhances field coverage and alignment accuracy, while the recessed cavity ensures consistent positioning and user comfort during diagnostic procedures.

## Design Novelty

The novelty lies in the distinctive enlarged geometric optical module combined with a minimalistic and symmetrical front architecture. The absence of multiple controls and external attachments results in a clean, recognizable form that differentiates it from conventional ophthalmic instruments.

### AI-POWERED PORTABLE EYE SCREENING DEVICE

SMART VISION CARE • ACCURATE SCREENING • IDEAL FOR RURAL HEALTHCARE

- MULTI-LENS IMAGING SYSTEM**  
Captures high-resolution images of the retina for accurate and early eye disease detection.
- LED ILLUMINATION RING**  
Provides uniform lighting for clear image capture in all environments.
- AI-POWERED ANALYSIS**  
Built-in AI algorithms analyze images and provide instant screening results and risk scores.
- RECHARGEABLE BATTERY**  
Long-lasting battery ensures uninterrupted screening even in remote areas.
- PATIENT ALIGNMENT & CHIN REST**  
Ensures proper alignment and steady positioning for clear and consistent image capture.
- PORTABLE & DURABLE DESIGN**  
Lightweight, compact, and rugged design ideal for mobile clinics and rural outreach.

**HD TOUCHSCREEN DISPLAY**  
Instant preview and results display with intuitive interface for easy operation.

**ONE-TOUCH OPERATION**  
Simple one-button operation for quick capture and efficient screening workflow.

**USABLE FOR RURAL AREA**

- BUILT FOR RURAL NEEDS**  
Compact, easy to carry and operate – perfect for remote locations and outreach camps.
- DEPENDABLE PERFORMANCE**  
Works reliably in areas with limited power supply, dust, heat, and challenging conditions.
- EASY TO USE**  
Minimal training required. Simple workflow for healthcare workers.
- BETTER EYE CARE ACCESS**  
Enables early detection and timely referrals – improving community eye health.

**ONE DEVICE. COMPLETE SCREENING. BETTER VISION FOR EVERY COMMUNITY.**

## Functional Novelty

The design integrates multiple sensing and imaging functionalities within a single front-facing module, enabling simplified and rapid diagnostic operation. The configuration supports consistent measurements with minimal user intervention, making it particularly suitable for accessible and scalable deployment in underserved rural environments.

## **It is Better than Other Traditional Instruments**

The handheld ophthalmic diagnostic device is superior to traditional ophthalmic instruments as it integrates multiple diagnostic and imaging functions into a single compact unit. Unlike bulky conventional systems, it offers portability, ergonomic handling, stable eye alignment, and simplified operation. The integrated design reduces dependence on external accessories and enables efficient examinations in a wider range of settings.

## **Benefits of the Instrument**

- Compact and lightweight construction.
- Easy portability and field deployment.
- Ergonomic design for comfortable single-hand operation.
- Stable and consistent eye alignment.
- Integrated imaging and optical sensing capabilities.
- Simplified control interface for user convenience.
- Reduced setup time and operational complexity.
- Improved accessibility for routine eye screening and diagnostics.

## **Detailed Description of the Design**

The device comprises an elongated housing having smooth, continuous contours and an ergonomic profile. The upper portion includes an optical module with multiple optical apertures arranged around a central imaging region. A display screen is provided on the front surface for visualization of information and examination data. A circular control element is positioned below the display for operational control. The lower portion incorporates a recessed viewing cavity configured to align with the eye and assist in maintaining stable positioning during examination. The side surfaces are smoothly contoured to enhance grip and handling, while the housing encloses the internal optical, sensing, electronic, and power components within a unified structure.

## **Purpose of the Design**

The purpose of the design is to provide a portable ophthalmic diagnostic device that enables efficient ocular examination and screening while improving usability, accessibility, alignment accuracy, portability, and user comfort.

## **Construction of the Design**

- The design is constructed from:
  - An ergonomic handheld housing.
  - An integrated optical imaging and sensing module.
  - Multiple optical apertures arranged around a central imaging region.
  - A front-mounted display screen.
  - A circular control interface.
  - A recessed viewing cavity for eye positioning and alignment.
  - Internal electronic, optical, sensing, communication, and power components enclosed within the housing.

## **Conclusion**

AI-integrated ophthalmic devices are revolutionizing eye care by enabling automated disease screening, achieving diagnostic sensitivity of up to approximately 90% for conditions like diabetic retinopathy. These devices are ensuring the accessibility of vision-saving technology in underserved regions. Deep learning algorithms detect glaucoma, age-related macular degeneration, and cataracts with high accuracy by analyzing Optical Coherence Tomography, B-scan, and fundus photography.

To fully leverage this groundbreaking innovation, the medical community must shift from single-task classifiers toward 'multimodal foundation models' that integrate medical imaging, electronic health records, and clinical text or documentation. Ensuring their safe and sustainable deployment requires continuous,

multidisciplinary collaboration among software developers, medical experts, and regulatory bodies to guarantee equity and transparency.

AI-integrated ophthalmic diagnostic devices have brought about a revolutionary change in eye care. By combining automated, high-resolution imaging with deep learning, these systems match or even surpass human experts in detecting conditions like diabetic retinopathy and glaucoma, thereby enabling earlier diagnosis and more accessible treatment.

## **References**

No need for reference.