A Novel Low-Cost and Portable Device for the Early Detection of Diseases in the Retina

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Summary:

This project focuses on creating a low-cost, portable alternative to conventional Optical Coherence Tomography (OCT) systems for retinal disease detection. Traditional OCT instruments are highly effective but remain expensive and non-portable, making them impractical in rural or low-resource healthcare settings. To address this gap, the device combines affordable embedded hardware with artificial intelligence to enable real-time eye screenings outside of hospital environments.

Built around a Raspberry Pi 5, the prototype integrates high-definition and infrared imaging cameras that capture and fuse detailed retinal views. The fused images highlight key retinal structures and blood vessels, providing diagnostic clarity similar to that of OCT outputs. These images are processed by an EfficientNet-based deep learning model trained to recognize 45 retinal diseases, including glaucoma, diabetic retinopathy, and macular degeneration. The complete system costs under ₹20 000, roughly one-hundredth the price of commercial OCT units, making advanced retinal diagnostics feasible in schools, village clinics, and community health programs.