Automated Retinopathy Diagnosis System with Real-Time Image Processing

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Executive Summary

Diabetic retinopathy (DR) is a major cause of blindness, especially in areas with limited access to medical equipment. Our project aims to solve this problem by creating an affordable, portable, and easy-to-use solution that uses smartphone-based retina imaging app and AI to detect DR early. We plan to use a 30-diopter lens attached to a smartphone to take retina pictures. These pictures will be analyzed by an AI model, the results will be sent back to the mobile app, also the AI system will provide advisory recommendations while preserving the role of healthcare professionals. This system will make DR diagnosis easier, cheaper, and more accessible, especially in under-resourced communities.The system's affordability, portability, and reliance on software make it a game-changer in global healthcare .

Problem Statement

Diabetic retinopathy is the main cause of preventable blindness around the world, affecting over 100 million people each year. Current methods to detect DR are expensive and require skilled professionals, making them hard to access in many areas. Without early detection, the disease can lead to permanent blindness and worsen the lives of those affected.

Proposed Solution

Current equipment for detecting diabetic retinopathy, like fundus cameras and slit lamps, are costly, need a physical space,used manually and require electricity. These limitations make them hard to use in rural and low-resource areas.

Our solution is a low-cost, portable, automated and easy-to-use system that works without electricity or required large physical spaces. This system is especially useful for rural areas where it can help detect DR early, reduce the risk of blindness, and allow for timely treatment.

Key features of our solution include:

- **Image capturing system :** A smartphone-based system with a 30-diopter lens to capture retina Image
- **Cloud-Based Analysis:** A deep learning model for accurate DR classification.
- **AI Assistance**: Ethical, AI-driven recommendations to assist users and doctors.

Target Beneficiaries:

- Combines affordability with cutting-edge AI technology.
- A system designed to minimize costs and eliminate the need for expensive equipment.
- Automation complements, rather than replaces, human expertise.

Implementation Plan:

- Develop a mobile app that helps users take retinal images.
- Connect the app to a cloud platform where images can be analyzed by the trained AI model.
- Provide health advice and recommendations through an AI bot in the app.

Project Duration: 12 months with several phases.

Goals and Objectives

Long-term Goal:

- Reduce blindness caused by diabetic retinopathy in under-resourced and rural areas . .
- Equip healthcare with advanced cutting-edge AI technologies .

Specific Objectives:

- Provide an affordable, portable, and easy-to-use solution that uses technology to improve healthcare.
- Offer a smarter, cost-effective way to reduce the number of people who go blind from DR.

Project Plan:

1. **Image Capture System**

- Integrate a 30-diopter lens with a smartphone camera for magnified retina imaging.
- Develop a mobile app to guide users during capture and securely transmit images to the cloud.

2. **Cloud-Based AI Analysis System**
    - Use deep-learning models to analyze retinal images and classify DR into stages (No DR,mild, moderate, severe, or proliferative).
    - Continuously improve the model with diverse datasets.
3. **AI Bot Integration**
    - Provide personalized advice or recommendations based on AI analysis.
    - Maintain transparency about AI's role as a supportive tool, not a replacement for doctors.
4. **Security and Privacy**
    - Ensure data encryption during transmission and storage.
    - Obtain explicit consent for data use.

Outputs and Outcomes

Outputs:

- A working smartphone-based diagnostic tool.
- A deployed AI system in the cloud.
- Reports from field testing.

Expected Outcomes

- **Affordability:** A system designed to minimize costs and eliminate the need for expensive equipment.
- **Accessibility:** Portable hardware and cloud-based software enable global scalability.
- **Efficiency:** Quick, accurate diagnosis with real-time feedback via the app.
- **Sustainability:** Minimal infrastructure requirements-only a smartphone with integrated lens, and internet connection are needed.
- **AI Use:** Ensures patients understand AI's role while empowering healthcare professionals**.**

Monitoring and Evaluation

To track the project's success, we will:

- Set clear goals, such as accuracy, speed of diagnosis, and user satisfaction.
- Collect and study field test data.
- Make improvements based on feedback from users and evaluations.

Ethical Considerations

- Transparency: AI outputs clearly communicated as advisory.
- Reliability: Focus on complementing, not replacing, medical professionals.
- Inclusivity: Simplify the system for non-technical users.

Timeline

Phase	Timeline	Milstone
Phase 1: Prototype	Months 1-3	Develop hardware and app prototype
Phase 2: AI Model	Months 4-6	Train and deploy AI model
Phase 3: Testing	Months 7-9	Conduct field trials
Phase 4: Deployment	Months 10-12	Launch the system and provide training

Budget

Item	Cost(PKR)
Lens and hardware setup	90000-120000
Mobile app development	30000
Cloud infrastructure	80000-100000
Field trials and evaluation	20000
Miscellaneous costs	15000

Conclusion

The Automated Retinopathy Diagnosis System aims to revolutionize the detection of DR using smartphone-based imaging, AI analysis in the cloud and ethical recommendations based on AI. This solution not only addresses the pressing need for accessible and affordable DR diagnosis but also aligns with global health goals of reducing preventable blindness through early intervention.With our solution, we hope to significantly reduce blindness and improve the lives of millions of people.

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