Smart Mirror – AI-Based Eyewear Suitability System

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Introduction

- Eyewear selection is often subjective and depends on manual judgment
- Customers face difficulty identifying frames suitable to their face shape
- Existing retail systems lack intelligent, data-driven recommendations
- Smart Mirror introduces AI-based eyewear suitability analysis for optical shops

Problem Statement

- Manual frame selection causes customer confusion and dissatisfaction
- Accurate face shape identification is difficult for average users
- Decisions rely heavily on shop staff opinions
- No dedicated system exists for personalized eyewear suitability in-store

Project Objectives

- Capture real-time facial images using a camera
- Detect facial features and landmarks
- Classify face shape using AI (CNN)
- Calculate eyewear suitability score (0–100%)
- Recommend the most suitable eyeglass frames

Project Scope

In-Scope

- Real-time face detection and analysis

- AI-based face shape classification

- Suitability scoring and frame recommendation

- Local database management

Out-of-Scope

- Online purchasing functionality

- Cloud-based data storage

- Augmented Reality virtual try-on

Proposed Solution

- A two-way mirror integrated with a display and camera
- Captures customer image in real time
- AI analyzes facial features and face shape
- System computes suitability score
- Recommended frames displayed directly on the mirror

System Architecture

- Camera Module for image capture
- Raspberry Pi as processing unit
- AI analysis module using CNN
- Local SQLite database for frame data
- Display screen mounted behind two-way mirror

Technology Stack

- Programming Language: Python
- Computer Vision: OpenCV
- Artificial Intelligence: CNN, TensorFlow Lite
- Hardware: Raspberry Pi, Camera Module, LED Display
- Database: SQLite
- Operating System: Raspberry Pi OS

Functional Requirements

- Capture facial image in real time
- Detect face and extract landmarks
- Classify face shape using AI
- Calculate suitability percentage
- Recommend better eyewear frames
- Display results on the smart mirror

Non-Functional Requirements

- Response time under 5 seconds
- Local data processing for privacy
- Secure handling of user data
- Reliable performance under indoor lighting
- User-friendly and minimal interface

Methodology / Workflow

- Image capture through camera
- Face detection and preprocessing
- Face shape classification using CNN
- Suitability score calculation
- Frame matching from local database
- Output display on mirror screen

Design Strategies

- Edge Computing to ensure privacy and reliability
- AI model optimization using TensorFlow Lite
- Minimal "Magic Mirror" style user interface
- No dependency on continuous internet connection

Expected Results

- Accurate face shape detection
- Intelligent eyewear recommendations
- Reduced customer indecision
- Improved shopping experience
- Functional prototype suitable for optical shops

Future Enhancements

- Integration of Virtual Try-On using AR
- Expansion of eyewear frame database
- Mobile or web application support
- Improved AI accuracy with larger datasets

Conclusion

- Smart Mirror provides AI-based eyewear suitability analysis
- Eliminates guesswork in frame selection
- Enhances customer satisfaction and retail efficiency
- Demonstrates practical application of AI in retail systems