Hand Danger Detection System

Overview

This project demonstrates a real-time hand proximity detection system that identifies SAFE, WARNING, and DANGER states using classical computer vision techniques (no MediaPipe or OpenPose). The system tracks a bare hand via YCrCb skin detection, computes distance from a virtual boundary, and displays visual alerts.

Features

- Real-time bare-hand tracking (OpenCV)
- Virtual boundary interaction
- SAFE / WARNING / DANGER state classification
- Classical CV (no pose-estimation APIs)
- High FPS on CPU-only execution

How It Works

1. Webcam feed captures frames in real time.

2. Skin regions are detected using YCrCb color space.

3. The largest valid contour is treated as the hand.

4. The hand's centroid is computed.

5. Distance to a virtual boundary line determines:

- SAFE: Hand far from boundary
- WARNING: Hand approaching
- DANGER: Hand very close/touching

Requirements

- Python 3.x
- OpenCV
- NumPy

Running the Project

Run the following command:

```

python hand_danger_demo.py
```

Demo Includes

- Source code
- Screenshots of SAFE, WARNING, DANGER states
- MP4 demo video

Conclusion

This POC successfully demonstrates real-time hand–boundary interaction using classical computer vision, meeting performance and functional requirements without pose-detection APIs.