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Hand-Gesture Powered Media Control using OpenCV

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Abstract: *In recent years, touchless human-computer interaction has gained significant attention, especially in applications requiring intuitive control mechanisms. This project presents a real-time hand gesture-based volume control system using OpenCV, MediaPipe, and PyCaw. The system leverages computer vision and machine learning to track hand landmarks, detect gestures, and dynamically adjust system volume based on finger positioning. MediaPipe is used for efficient and robust hand tracking, while OpenCV processes the video feed in real time. The PyCaw library interfaces with the system's audio settings to enable seamless volume control.*

The application detects the user's hand through a webcam, identifies key landmarks such as the thumb and index finger, and calculates their distance to determine the desired volume level. When the fingers move closer, the volume decreases; when they move apart, the volume increases. This solution provides a contactless, intuitive, and user-friendly way to control audio levels, which is especially useful in gesture-based interfaces, smart environments, and assistive technologies. The system is lightweight, runs efficiently on standard hardware, and does not require additional external sensors. This work demonstrates the potential of computer vision and AI-driven interaction systems, offering a practical and innovative alternative to traditional input methods.

Keywords: Hand Gesture Recognition, Computer Vision, OpenCV, MediaPipe, PyCaw, Real-Time Volume Control