Gesture Volume Control with Hand Gestures

Batch Num : 2

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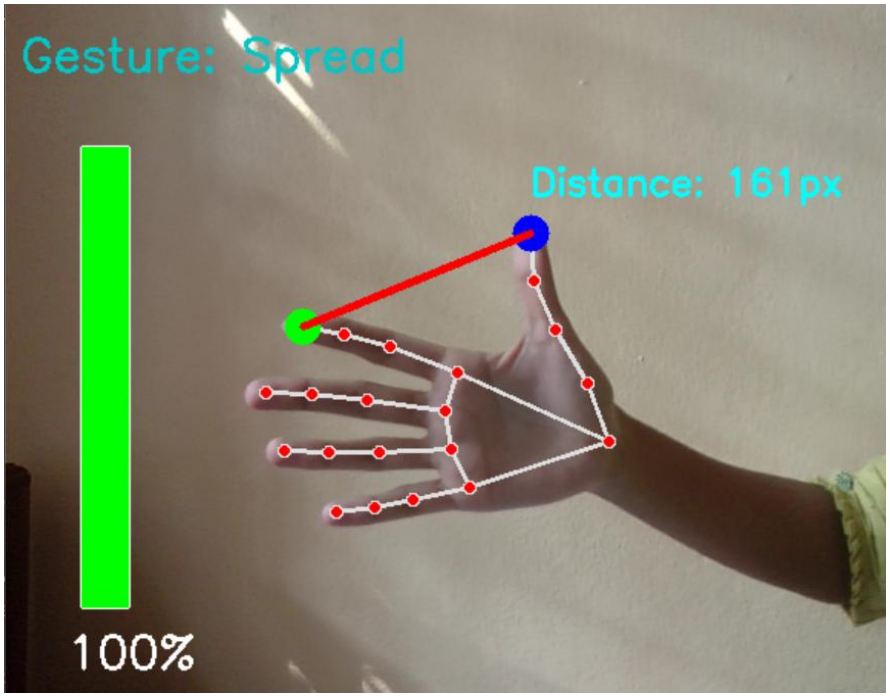
Libraries Used: OpenCV, Mediapipe, Pyautogui

Introduction

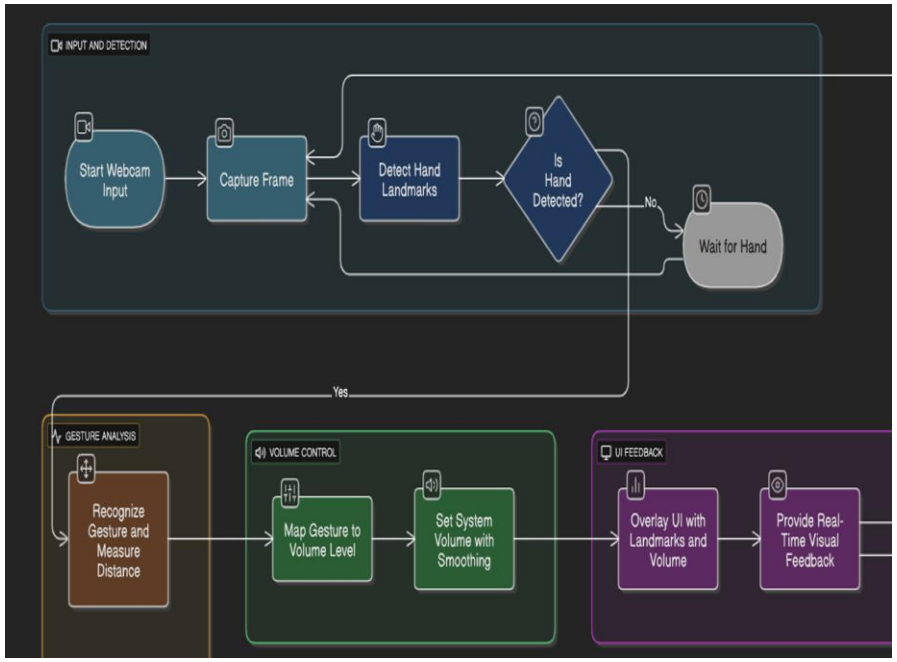
This project builds a computer vision-based system to control volume using hand gestures. It detects hand landmarks via MediaPipe and maps gesture distances to volume levels.

Enables touch-free, intelligent interface for smart environments and assistive tech.



Workflow of the Project

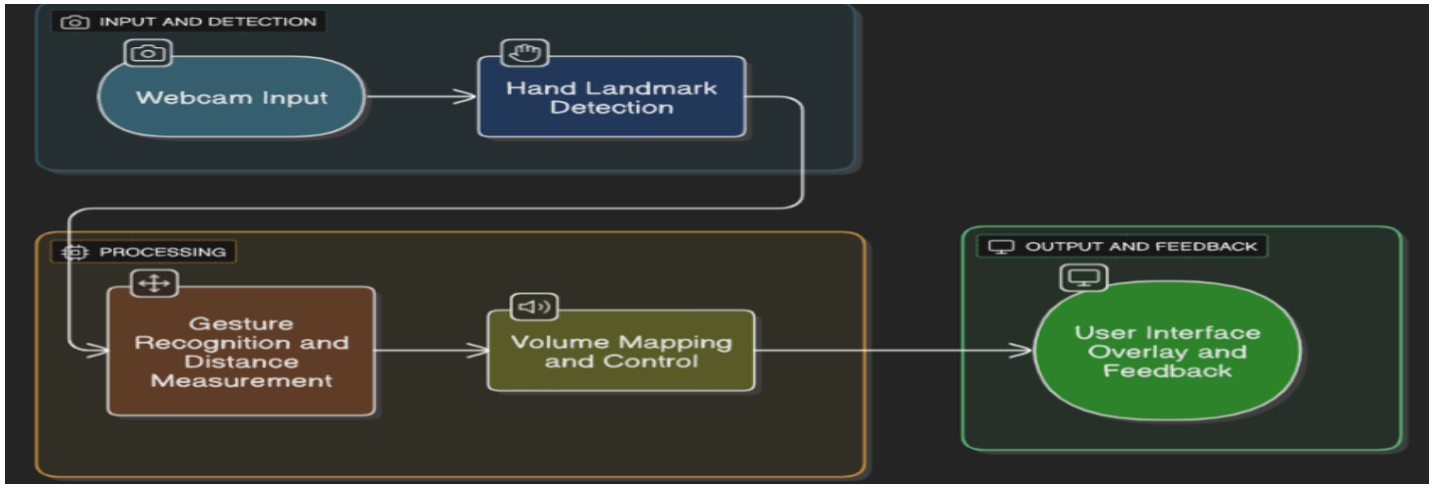
1. Capture real-time video using OpenCV.
2. Detect hand landmarks using MediaPipe.
3. Measure distance between thumb and index finger.
4. Map gesture distance to system volume via Pycaw.
5. Display feedback on live feed.



Architecture Diagram

Components:

- Webcam Input → captures frames
- MediaPipe Hand Detector → detects 21 landmarks
- Gesture Analyzer → calculates distance
- Volume Control Logic → maps distance to % volume
- UI Feedback → overlays volume level on video feed



Implementation Details

Language: Python

IDE: PyCharm

Libraries: OpenCV, MediaPipe, PyAutoGUI, NumPy, Math

Key Features:

- Real-time gesture detection
- Dynamic system volume adjustment
- Smooth transitions without hardware

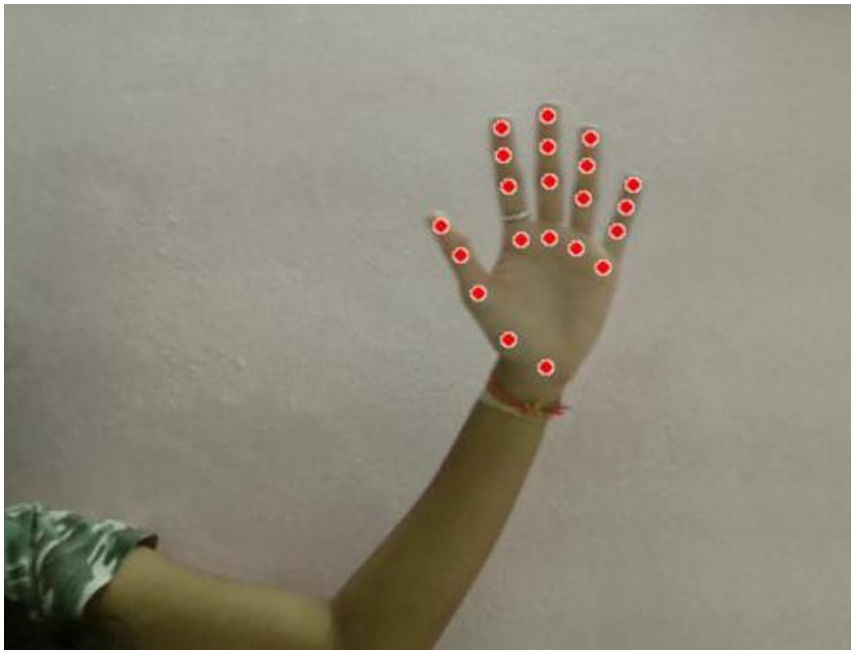
Milestone 1

Module: Webcam Input & Hand Detection

Tools: OpenCV, MediaPipe

Tasks: Integrated webcam, detected 21 hand landmarks.

Output: Live webcam feed showing hand landmarks.



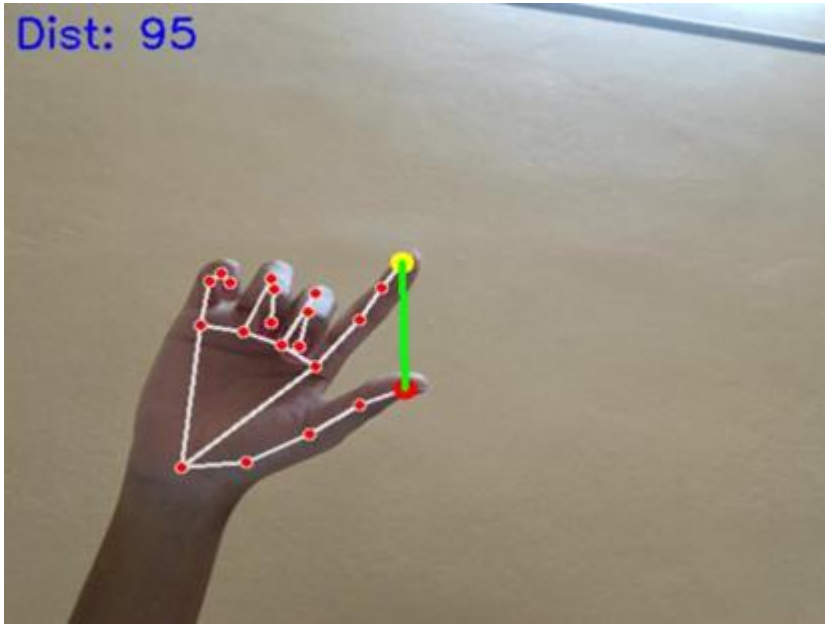
Milestone 2

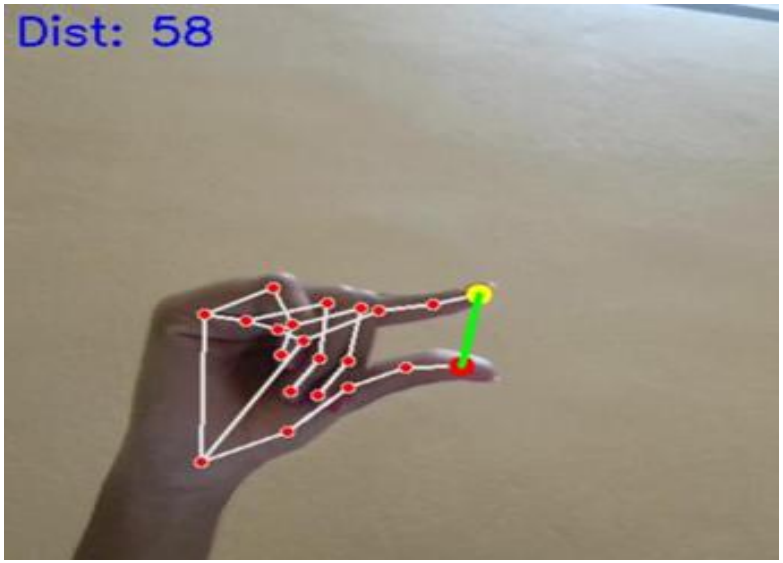
Module: Gesture Recognition & Distance Measurement

Tasks: Calculated distance between thumb & index finger,

classified gestures.

Output: Displayed distance values and gesture annotations.





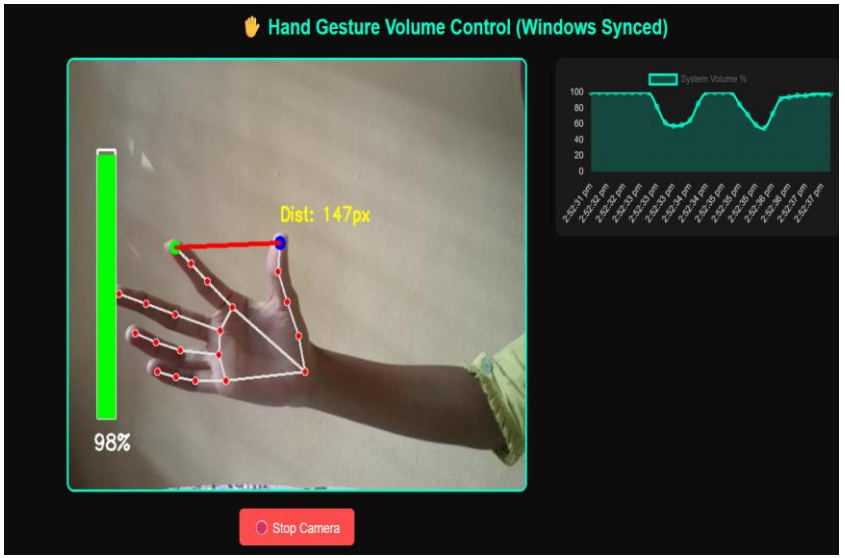
Milestone 3

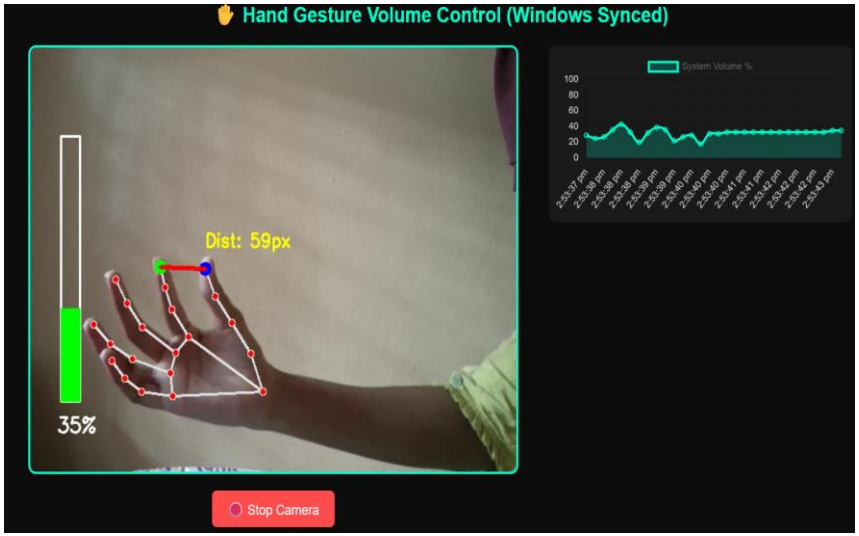
Module: Volume Mapping & Control

Tasks: Mapped gesture distances to volume levels,

integrated Pycaw for control.

Output: Smooth, real-time system volume control.



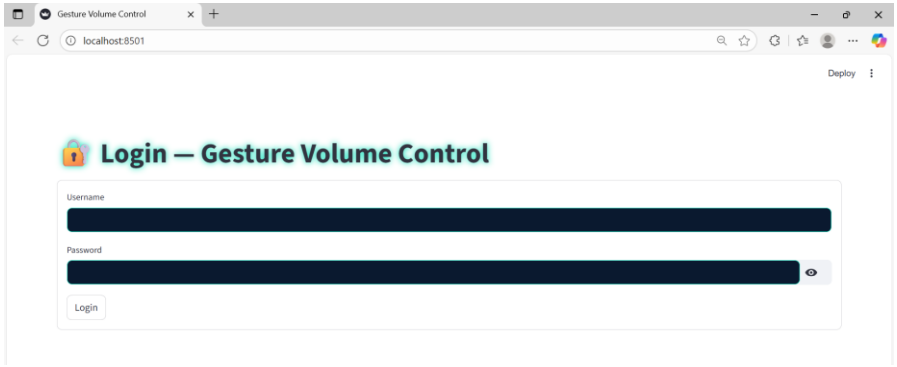


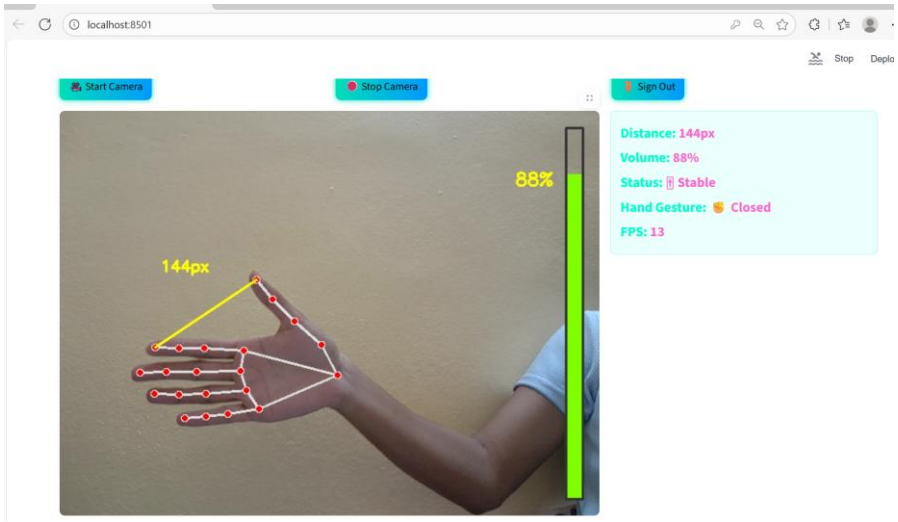
Milestone 4

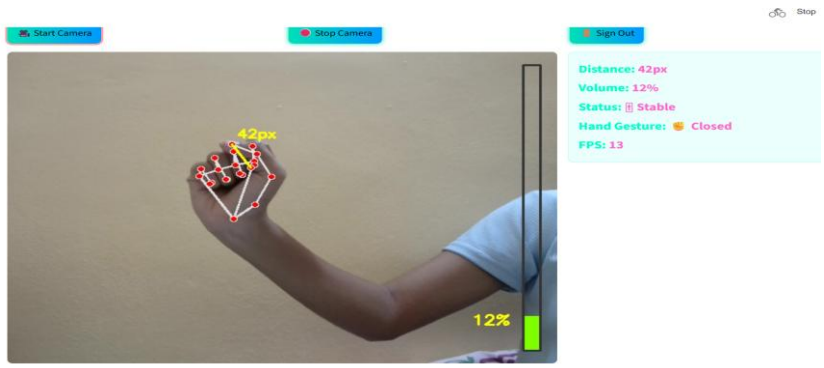
Module:User Interface & Feedback

Tasks: Displayed feedback messages: “Min Volume”, “Max Volume”, “Good Gesture”, “Volume Increasing/Decreasing”.

Output: Real-time gesture recognition with visual feedback.

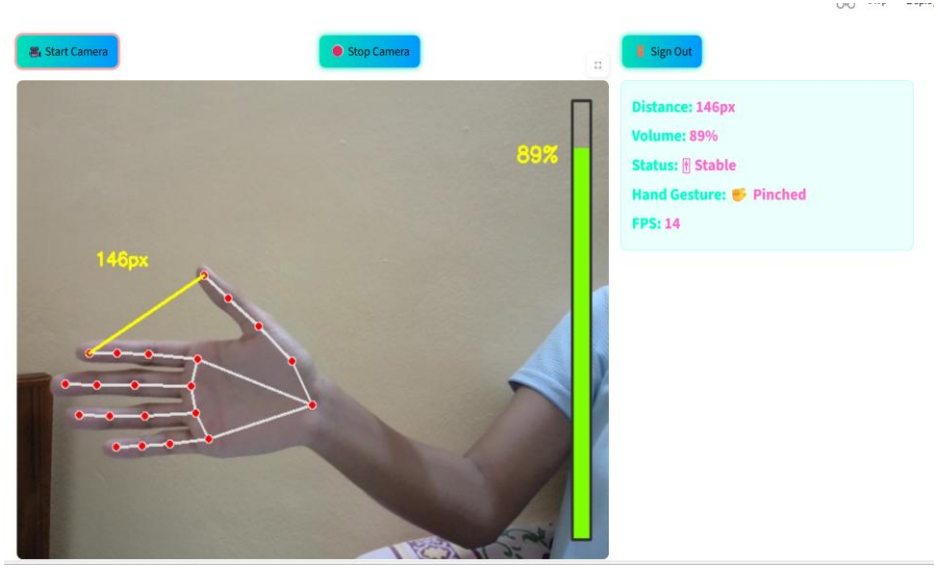






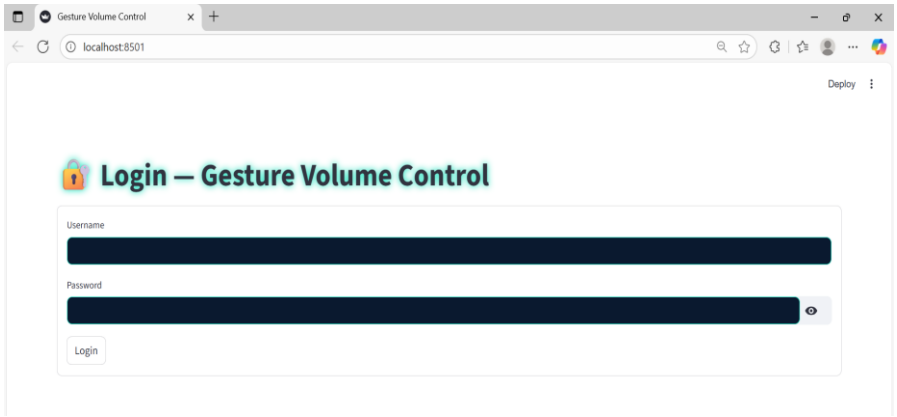
Final Result

- Fully functional system adjusting Windows volume using hand gestures.

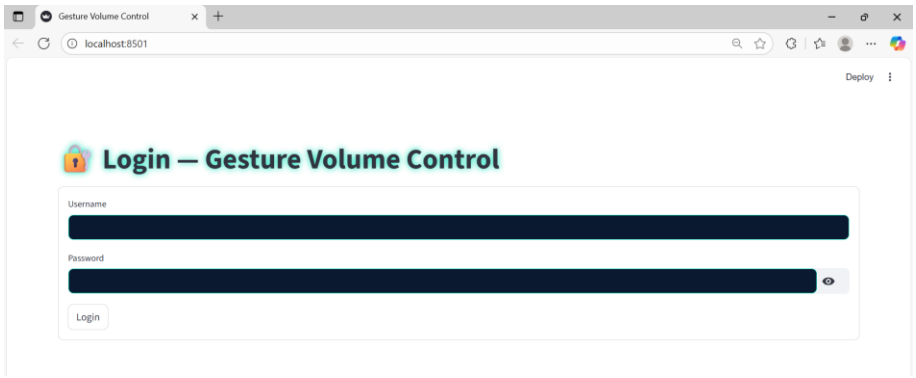


- Real-time visual feedback with UI overlay.

- Works smoothly without mouse or keyboard.



Final Result



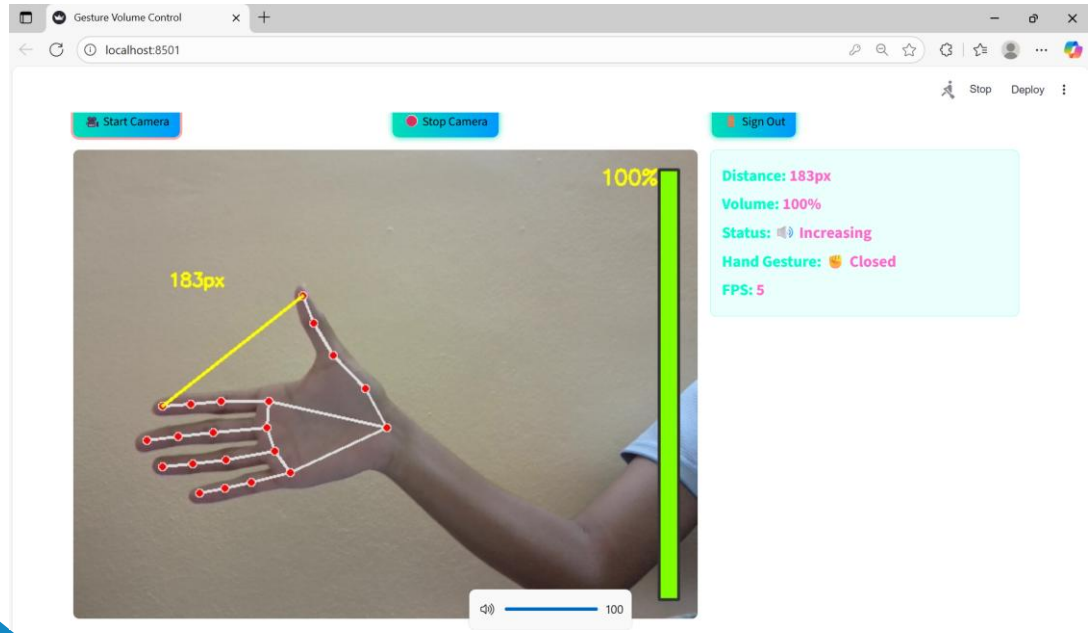
Distance: 133px

Volume: 80%

Status: Stable

Hand Gesture: Pinched

FPS: 11



Challenges Faced and Solutions Implemented

1.Hand Detection: Improved accuracy with optimized MediaPipe settings.

2.Gesture Errors: Fixed misread gestures using stability checks.

3.Performance Lag: Reduced FPS drops by optimizing code and frame size.

4.Volume Fluctuation: Added smooth control using distance thresholds.

5.UI & Security: Enhanced interface with CSS and added a login page.

Conclusion

The project successfully implements gesture-based system volume control.

It enhances interaction using AI and computer vision for hands-free control.

Future scope: Extend to gesture-based media or brightness Control.

Thank You…