CSE 410

Computer Vision

"WAVECONTROL"

HANDS-FREE WINDOWS NAVIGATION

A Python Tkinter application to control windows features using human hand movements

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Windows Gesture Control

ABOUT IT

This Windows Gesture Control project uses a simple Tkinter interface to manage system functions like brightness, volume, mouse control, screenshots, and app switching via hand gestures. It integrates Mediapipe for gesture recognition, allowing users to interact with their computer hands-free through intuitive, customizable commands for seamless control.

KEY POINTS

1. **Project Overview**: The Windows Gesture Control project enables users to control system functions like brightness, volume, and app switching using gestures.

2. **Technology Stack**: It uses Python Open CV, Mediapipe for gesture recognition, Tkinter for the GUI.

3. **Key Features**: Includes gesture-based controls for brightness, mouse pointer, volume, screenshots, and application switching.

4. **User Interface**: A clean, responsive interface with buttons to activate different gesture controls, styled with a modern color palette.

5. **Objective**: To provide a hands-free, intuitive way to control , improving accessibility and user experience.

GOALS

Hands-Free Interaction: The goal is to enable users to control essential system functions like brightness, volume, mouse movement, and application switching using hand gestures, providing a hands-free experience that improves convenience and accessibility, especially for those with physical limitations.

Real-Time Gesture Recognition: By integrating Mediapipe's hand tracking and OpenCV for video processing, the project aims to achieve accurate, real-time gesture recognition, ensuring smooth and immediate execution of user commands, enhancing user experience and making the system intuitive and responsive.

Technology Used

TKINTER

Tikinter is a Python library used for creating graphical user interfaces (GUIs). In this project, Tkinter provides the user-friendly interface where users can interact with buttons that trigger different gesture-based controls. It manages the layout, button styling, and window configuration, allowing users to easily access features like brightness control, mouse control, and app switching, making the project accessible and intuitive.

OPEN CV

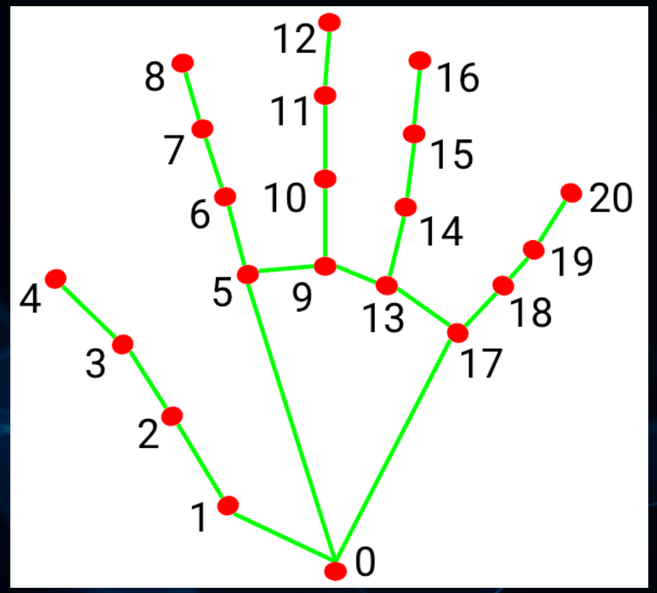
OpenCV (Open Source Computer Vision Library) is a popular open-source library for computer vision and image processing tasks. It provides tools for real-time image processing, such as object detection, face recognition, and motion tracking. In this project, OpenCV plays a key role by capturing and processing video frames from the webcam, enabling real-time gesture recognition when combined with Mediapipe. It allows tracking hand movements and identifying gestures to trigger system actions like adjusting brightness, controlling the mouse, or switching applications.

Technology Used

MEDIAPIPE

Mediapipe is a versatile machine learning framework by Google designed for real-time vision tasks like hand tracking and gesture recognition. In this project, mp.solutions.hands is used to detect, track, and process hand landmarks in real time, identifying specific hand gestures. These gestures are then mapped to control system functions such as adjusting brightness, managing mouse movement, or switching applications. This integration enables users to interact with their computers using intuitive hand movements, providing a seamless, touch-free control experience.

HAND LANDMARKS



0. WRIST	11. MIDDLE_FINGER_DIP
1. THUMB_CMC	12. MIDDLE_FINGER_TIP
2. THUMB_MCP	13. RING_FINGER_MCP
3. THUMB_IP	14. RING_FINGER_PIP
4. THUMB_TIP	15. RING_FINGER_DIP
5. INDEX_FINGER_MCP	16. RING_FINGER_TIP
6. INDEX_FINGER_PIP	17. PINKY_MCP
7. INDEX_FINGER_DIP	18. PINKY_PIP
8. INDEX_FINGER_TIP	19. PINKY_DIP
9. MIDDLE_FINGER_MCP	20. PINKY_TIP
10. MIDDLE_FINGER_PIP	

Mediapipe's hand landmarks refer to 21 specific points on each hand that represent key positions such as joints, tips, and the base of the fingers. These landmarks are critical for recognizing hand gestures and movements. The 21 landmarks are organized as follows:

- Wrist (landmark 0): The base point of the hand.
- Thumb: 4 landmarks (1-4) from the base to the tip.
- Index Finger: 4 landmarks (5-8), representing each joint up to the fingertip.
- Middle Finger: 4 landmarks (9-12).
- Ring Finger 4 landmarks (13-16).
- Pinky Finger: 4 landmarks (17-20).

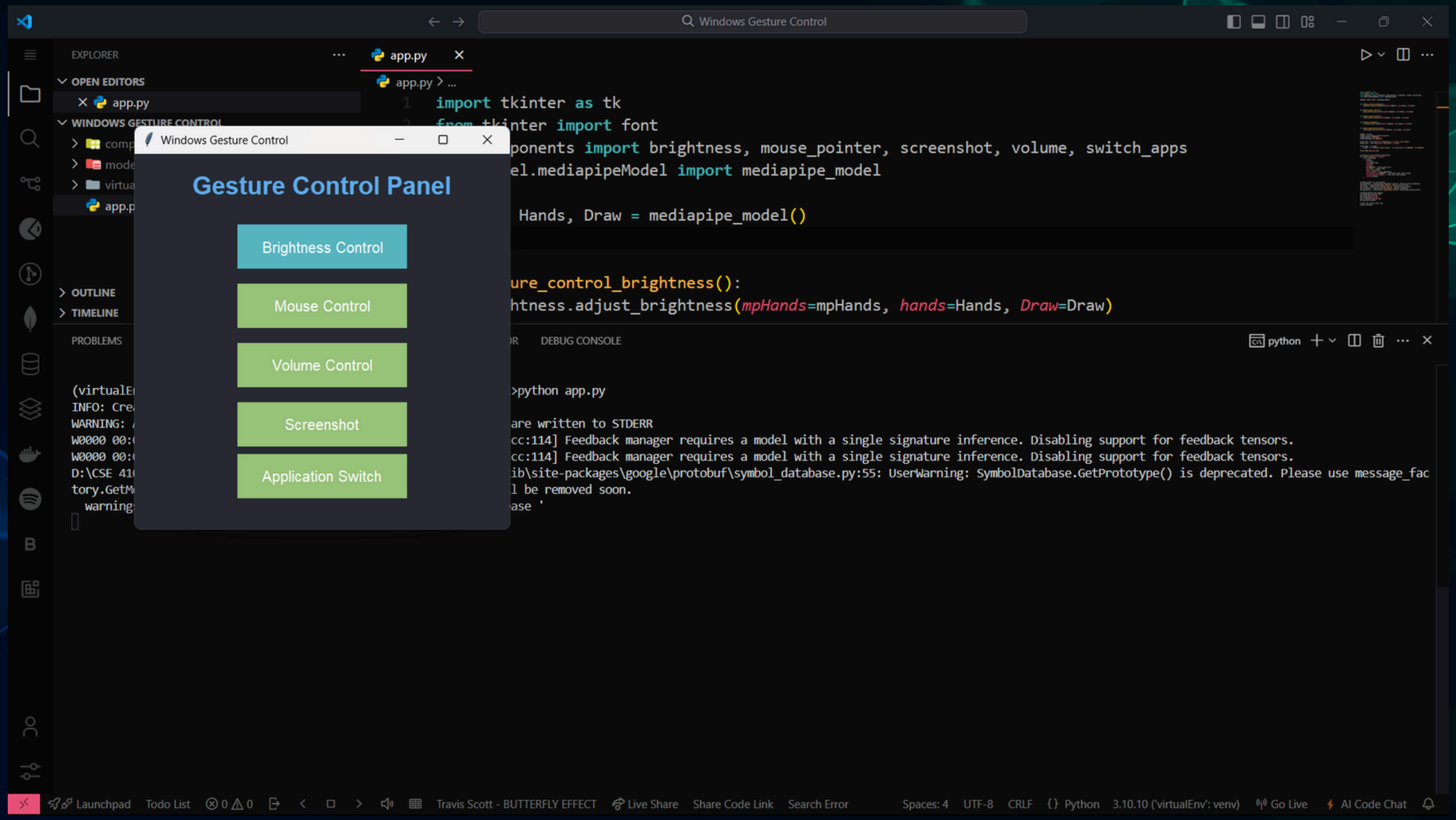
These landmarks enable accurate recognition of hand poses, movements, and gestures, crucial for interaction in gesture-based systems. Mediapipe identifies the relative positions of these points to detect specific gestures, like finger pinching, swiping, or pointing, enabling applications like this project to map gestures to actions such as mouse movement, volume control, or app switching.

PROJECT OUTPUTS

GUI APPLICATION WORKING AND OUTPUTS

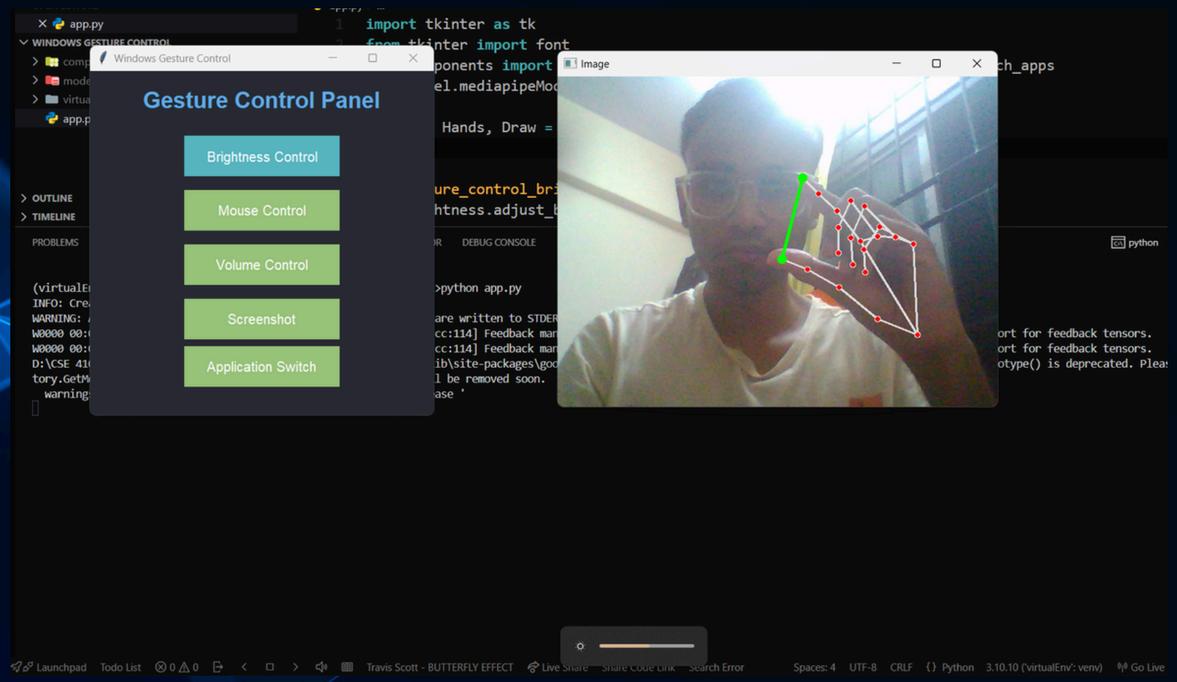
Project Outputs

TKINTER APPLICATION

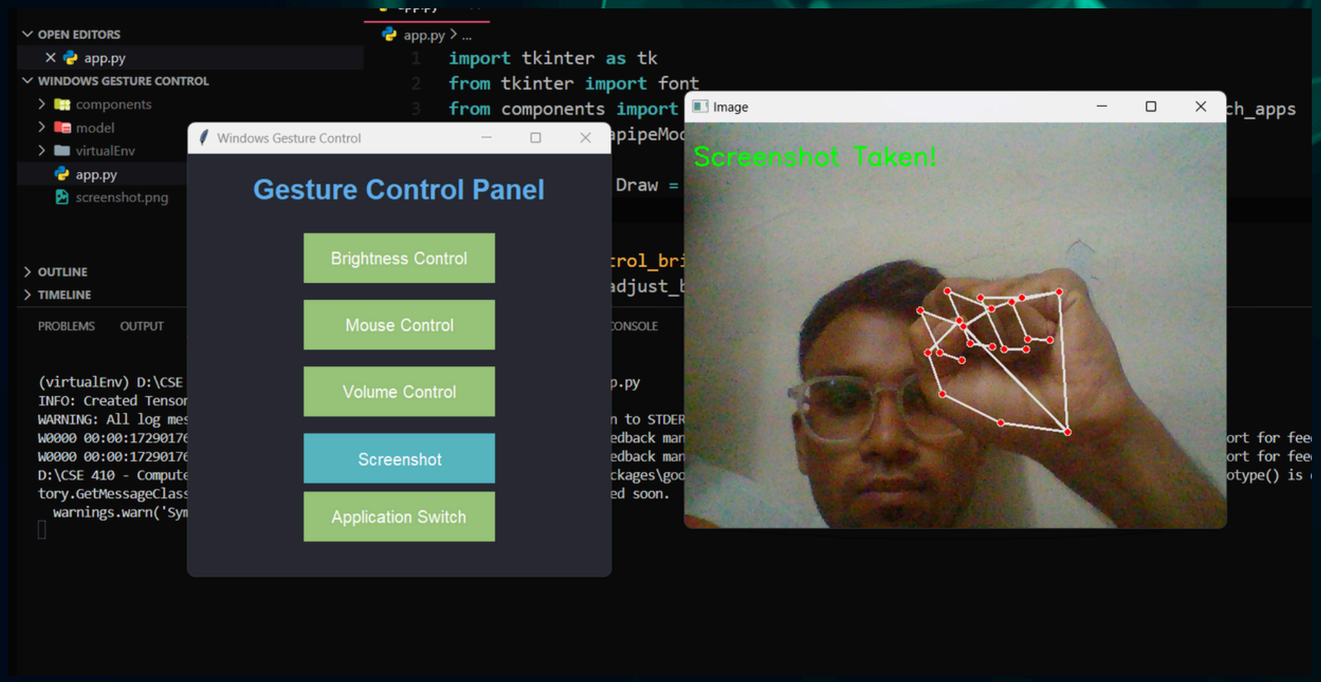


Project Outputs

BRIGHTNESS CONTROL

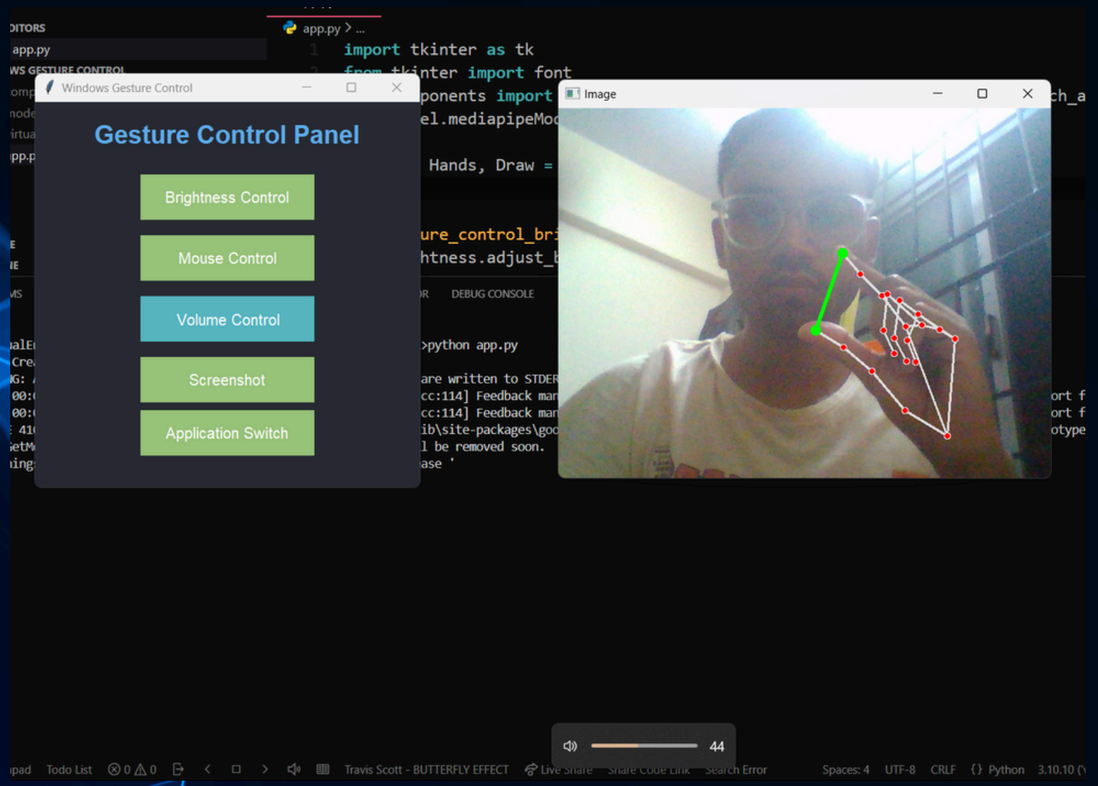


TAKING SCREENSHOT

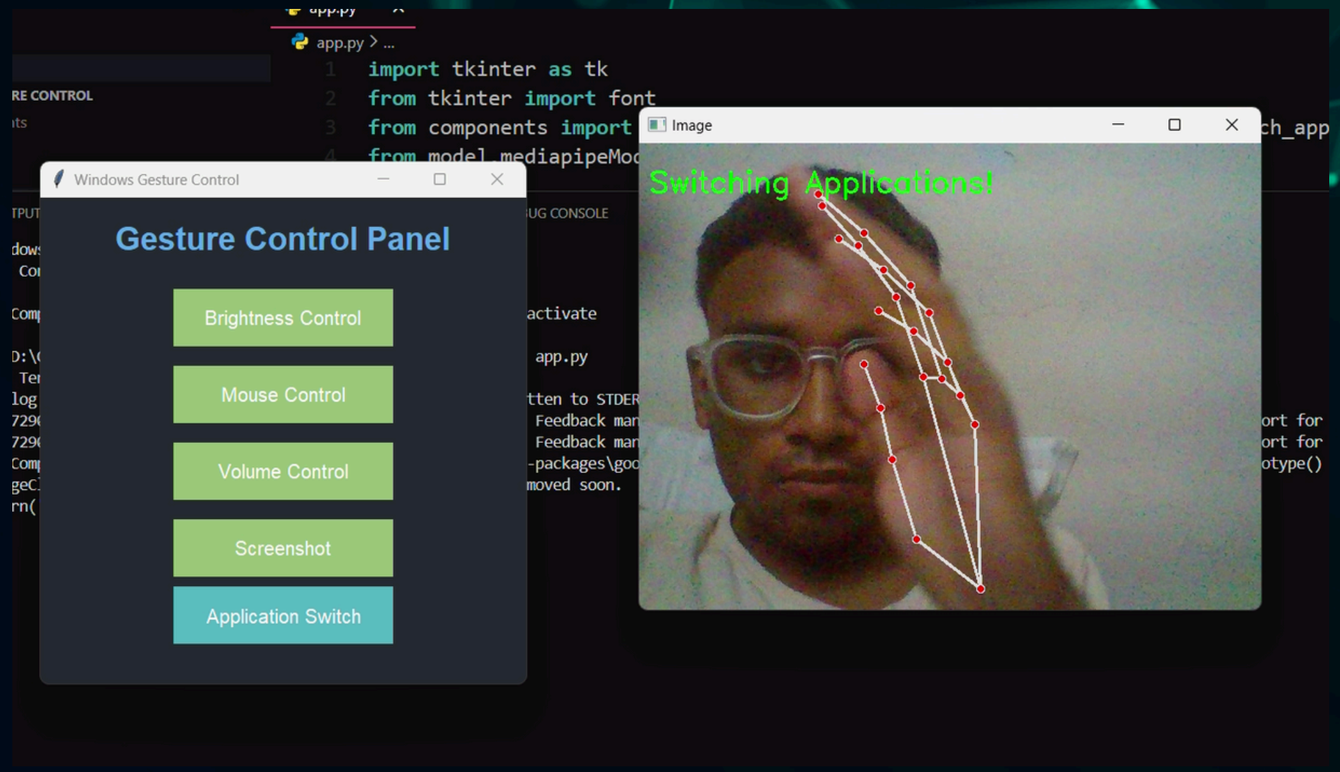


Project Outputs

VOLUME CONTROL



SWITCHING APPS



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THANK YOU!

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