Virtual Drag & Drop using Hand Tracking

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Overview

This Python project allows users to interact with on-screen rectangles using hand gestures detected by a webcam. It uses the OpenCV, cvzone, and NumPy libraries to track the hand, detect pinch gestures, and enable the user to 'drag' virtual boxes in real-time.

Modules Used

1. cv2 (OpenCV) – Handles video capture, image processing, and window display.
2. cvzone.HandTrackingModule – Simplifies hand detection and tracking using MediaPipe.
3. numpy (np) – Used for efficient numerical operations and array handling.

How It Works

1. Webcam Initialization: The webcam is accessed through cv2.VideoCapture(0) and set to1280×720 resolution.
2. Hand Detection: The HandDetector tracks the hand and identifies fingertips (index and middle). 3. Gesture Recognition: The distance between the index and middle fingers determines a grab action.
3. DragRect Class: Manages each draggable rectangle's position, size, color, and movement.
4. Drawing: Uses transparency to visually indicate which rectangles are grabbed.
5. Main Loop: Continuously reads webcam frames, detects hands, updates positions, and rendersthe display.
6. Exit Control: Press 'q' or 'ESC' to safely close the program and release the camera.

Key Features

- Real-time hand tracking and gesture detection.
- Interactive drag-and-drop using gestures.
- Smooth transparent overlay and color feedback.
- Proper camera cleanup on exit.

Requirements

Install the required dependencies:

```
pip install opencv-python cvzone numpy
```

Usage

1. Save the script as drag_drop.py.
2. Run it using: `python drag_drop.py`
3. Use index and middle fingers to grab and move rectangles.
4. Press 'q' or 'ESC' to exit safely.

Output

- Displays a live webcam window with five draggable rectangles that move with hand gestures.

End Note

- This project demonstrates how computer vision and gesture recognition can create natural, touchless interfaces. It’s a practical base for building AR, virtual control, or interactive UI systems powered by hand tracking.