## python code:

```
import cv2
import mediapipe as mp import serial
import time

# Initialize serial communication with Arduino

arduino = serial.Serial(port='COM4', baudrate=9600, timeout=1) time.sleep(2) # Wait for the serial connection to initialize

# Initialize Mediapipe mp_hands = mp.solutions.hands hands = mp_hands.Hands()
mp_drawing = mp.solutions.drawing_utils


# Function to detect individual fingers (1 for up, 0 for down) def detect_fingers(image, hand_landmarks):
finger_tips = [8, 12, 16, 20] # Index, middle, ring, pinky

thumb_tip = 4

finger_states = [0, 0, 0, 0, 0] # Thumb, Index,middle, ring, pinky


# Check thumb

if hand_landmarks.landmark[thumb_tip].x < hand_landmarks.landmark[thumb_tip - 1].x: finger_states[0] = 1 # Thumb is up

# Check the other fingers

for idx, tip in enumerate(finger_tips):

if hand_landmarks.landmark[tip].y < hand_landmarks.landmark[tip - 2].y:
```

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finger_states[idx + 1] = 1 # Other fingers are up


return finger_states


# Start capturing video cap = cv2.VideoCapture(0)

while cap.isOpened(): success, image = cap.read() if not success:
break


image = cv2.cvtColor(cv2.flip(image, 1), cv2.COLOR_BGR2RGB) results = hands.process(image)
image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)


if results.multi_hand_landmarks:

for hand_landmarks in results.multi_hand_landmarks: mp_drawing.draw_landmarks(image,
hand_landmarks, mp_hands.HAND_CONNECTIONS) fingers_state = detect_fingers(image,
hand_landmarks) arduino.write(bytes(fingers_state)) # Send list of fingers as bytes
print(f"Fingers State: {fingers_state}")


cv2.imshow('Hand Tracking', image) if cv2.waitKey(5) & 0xFF == 27:
break


cap.release() cv2.destroyAllWindows() arduino.close()
```