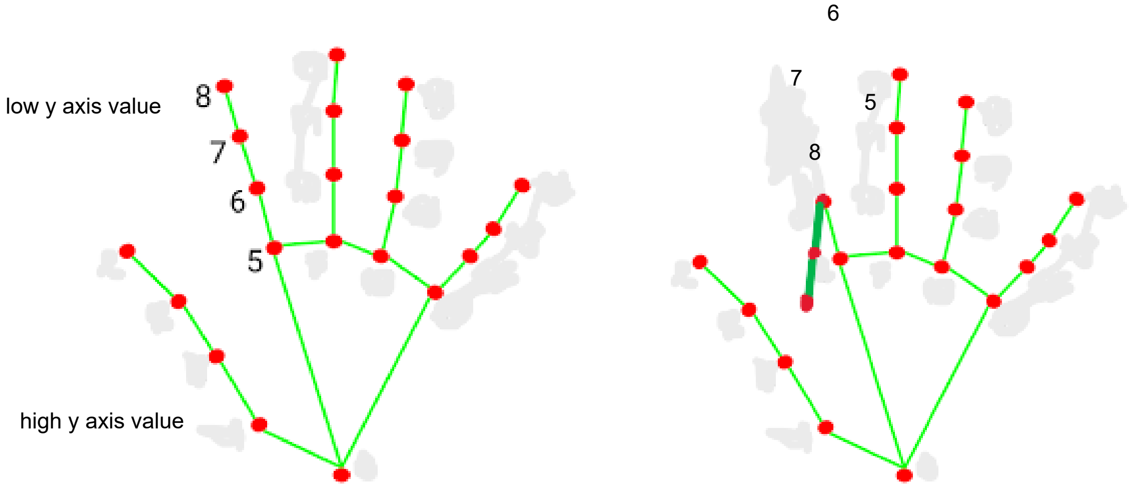
AI-Powered 4-DOF Robotic Arm Control using Hand Detection

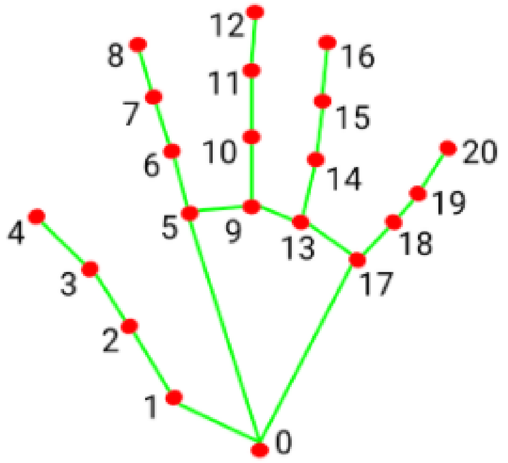


if landmark[8].y<landmark[6].y :
finger up

if landmark[8].y>landmark[6].y
: finger down

MediaPipe

An Open Source Machine Learning(ML) Framework
For Digital Image Processing
- Vision tasks (Object,Face,Pose,Hand Detection)
-Text Taks
-Audio Tasks



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

Python 3.11.9 Code In Sublime Text

Step 1: System Initialization

Import libraries (OpenCV, MediaPipe) and start the webcam video capture.

Step 2: Image Pre-processing

Read frame from the camera, convert color space .

Step 3: Hand Landmark Detection

Send image to the MEDIAPIPE algorithm to detect coordinates of 21 hand landmarks.

Step 4: Finger State Analysis (Logic)

Compare the coordinates of TIP VS KNUCKLE of each finger to determine if it is 'Open' or 'Closed'.

Step 5: Signal Stabilization

Store the last 15 frames of data in a history to remove jitter/noise.

Step 6: Visualization & Output

Draw the hand skeleton landmarks on the frame and display.