**Dependencies**

**opencv-python**: For working with computer vision (OpenCV).

**mediapipe**: For MediaPipe, used for hand/pose detection, etc.

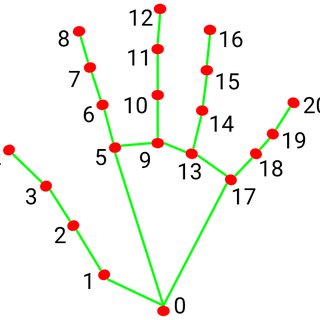
**pyautogui**: For GUI automation and controlling the mouse/keyboard.

**SpeechRecognition**: For handling speech-to-text (STT).

**Dependencies Install Command:** *pip install opencv-python mediapipe pyautogui SpeechRecognition*

**Python’s Mediapipe’s Hand Landmarks**

|  |  |  |
| --- | --- | --- |
| **Index** | **Landmark** | **Description** |
| 0 | Wrist | Base of the hand (near wrist). |
| 1 | Thumb CMC | First joint of the thumb. |
| 2 | Thumb MCP | Second joint of the thumb. |
| 3 | Thumb IP | Third joint of the thumb. |
| 4 | Thumb Tip | Tip of the thumb. |
| 5 | Index Finger MCP | Knuckle of the index finger. |
| 6 | Index Finger PIP | First joint of the index finger. |
| 7 | Index Finger DIP | Second joint of the index finger. |
| 8 | Index Finger Tip | Tip of the index finger. |
| 9 | Middle Finger MCP | Knuckle of the middle finger. |
| 10 | Middle Finger PIP | First joint of the middle finger. |
| 11 | Middle Finger DIP | Second joint of the middle finger. |
| 12 | Middle Finger Tip | Tip of the middle finger. |
| 13 | Ring Finger MCP | Knuckle of the ring finger. |
| 14 | Ring Finger PIP | First joint of the ring finger. |
| 15 | Ring Finger DIP | Second joint of the ring finger. |
| 16 | Ring Finger Tip | Tip of the ring finger. |
| 17 | Pinky Finger MCP | Knuckle of the pinky finger. |
| 18 | Pinky Finger PIP | First joint of the pinky finger. |
| 19 | Pinky Finger DIP | Second joint of the pinky finger. |
| 20 | Pinky Finger Tip | Tip of the pinky finger. |



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**Abbreviations:**

* **MCP (Metacarpophalangeal)**: The knuckle where the finger meets the palm.
* **PIP (Proximal Interphalangeal)**: The first joint in the finger.
* **DIP (Distal Interphalangeal)**: The second joint in the finger.
* **IP (Interphalangeal)**: The thumb's equivalent of DIP.

**Functionalities**

**Control Cursor Movement:** Tip of Index Finger (extend and hold Index Finger).

**Left Click:** Extend Index and Middle Finger once.

**Double Left Click:** Hold Extension of Index and Middle Finger for more than 1 second.

**Right Click:** Extend Index Finger, Middle Finger and Ring Finger once.

**Voice Input:** Extend Index, Middle, Ring and Pinky Finger once.

**Recent Apps Screen:** Extend all 5 fingers once

**Hold Left Mouse Button:** Closed Fist

**CONSISE WORKING CONCEPT**

**Gescon.py**

 **Setup**:

* Use the webcam to capture live video.
* Define on-screen zones for interaction and gestures.

 **Hand Tracking**:

* Use AI to detect hand movements and identify key finger positions.

 **Cursor Control**:

* Move the mouse pointer by tracking the index finger within a predefined zone.

 **Gesture Recognition**:

* Recognize different finger combinations to perform actions:
  + **Single/Double Click**: Index and middle fingers extended.
  + **Right-Click**: Three fingers extended.
  + **Scrolling**: Four fingers extended.
  + **Recent Apps**: Five fingers extended.
  + **Drag**: Closed fist.

 **Visual Feedback**:

* Display boxes on the video to indicate interaction areas.

 **Exit**:

* Quit the program when the user presses the **'q' key**.

**STT.py**

 **Initialize**:

* Set up speech recognition and a small status window to display feedback.

 **Wait for Speech**:

* Open the microphone and wait for the user to speak, with a time limit for input.
* Display a **"Waiting for voice input..."** message in a popup.

 **Process Input**:

* If speech is detected, convert it to text using Google’s Speech Recognition API.
* Handle errors if no speech is recognized or if the service is unavailable.

 **Simulate Typing**:

* If valid text is recognized, automatically type it using simulated keystrokes.

 **Exit**:

* Close the feedback window and end the program if no input is detected or if recognition fails.