MILESTONE 2

Controlling Volume with Hand Gestures using a Webcam

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INSTALLATIONS

INSTALLATION OF TENSORFLOW

```
(base) C:\Users\Pranesh>pip install tensorflow
```

```
Installing collected packages: namex, libclang, flatbuffers, termcolor, tensorboard-data-server, optree, opt_einsum, ml_dtypes, grpcio, google_pasta
, gast, astunparse, absl-py, tensorboard, keras, tensorflow
Successfully installed absl-py-2.3.1 astunparse-1.6.3 flatbuffers-25.9.23 gast-0.6.0 google_pasta-0.2.0 grpcio-1.76.0 keras-3.12.0 libclang-18.1.1 m
l_dtypes-0.5.3 namex-0.1.0 opt_einsum-3.4.0 optree-0.17.0 tensorboard-2.20.0 tensorboard-data-server-0.7.2 tensorflow-2.20.0 termcolor-3.2.0
```

VERSION OF TENSORFLOW

```
>>> print("TensorFlow Version:", tf.__version__)
TensorFlow Version: 2.20.0
```

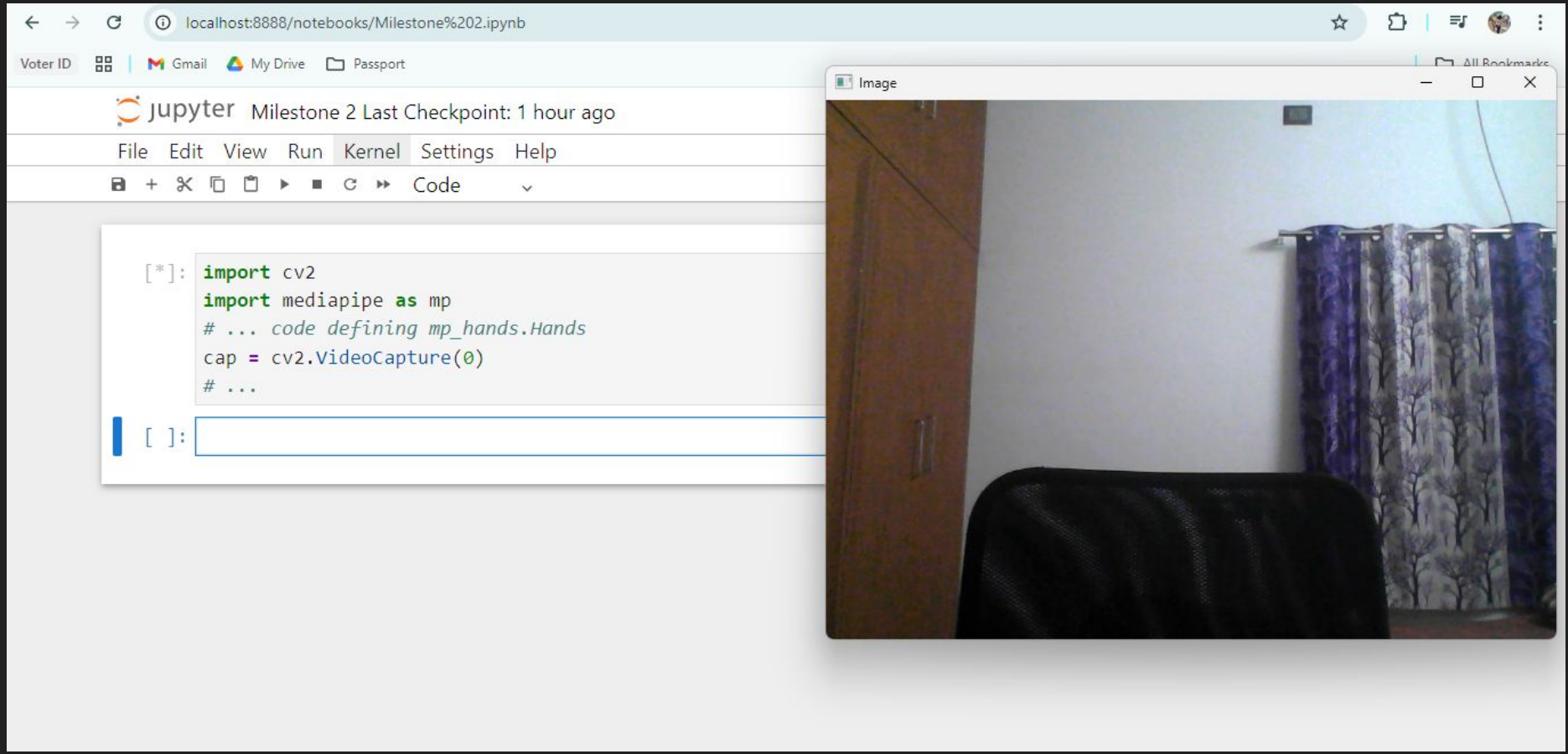
VERSIONS OF OPENCV , NUMPY , MEDIAPIPE , PANDAS AND MATPLOTLIB

[1]:
```
import cv2
import numpy as np
import mediapipe as mp
import pandas as pd
import matplotlib

print("OpenCV (cv2) version:", cv2.__version__)
print("NumPy version:", np.__version__)
print("MediaPipe version:", mp.__version__)
print("Pandas version:", pd.__version__)
print("Matplotlib version:", matplotlib.__version__)
```

```
OpenCV (cv2) version: 4.11.0
NumPy version: 1.26.4
MediaPipe version: 0.10.21
Pandas version: 2.3.3
Matplotlib version: 3.10.7
```

INITIALIZING WEBCAM USING OPENCV



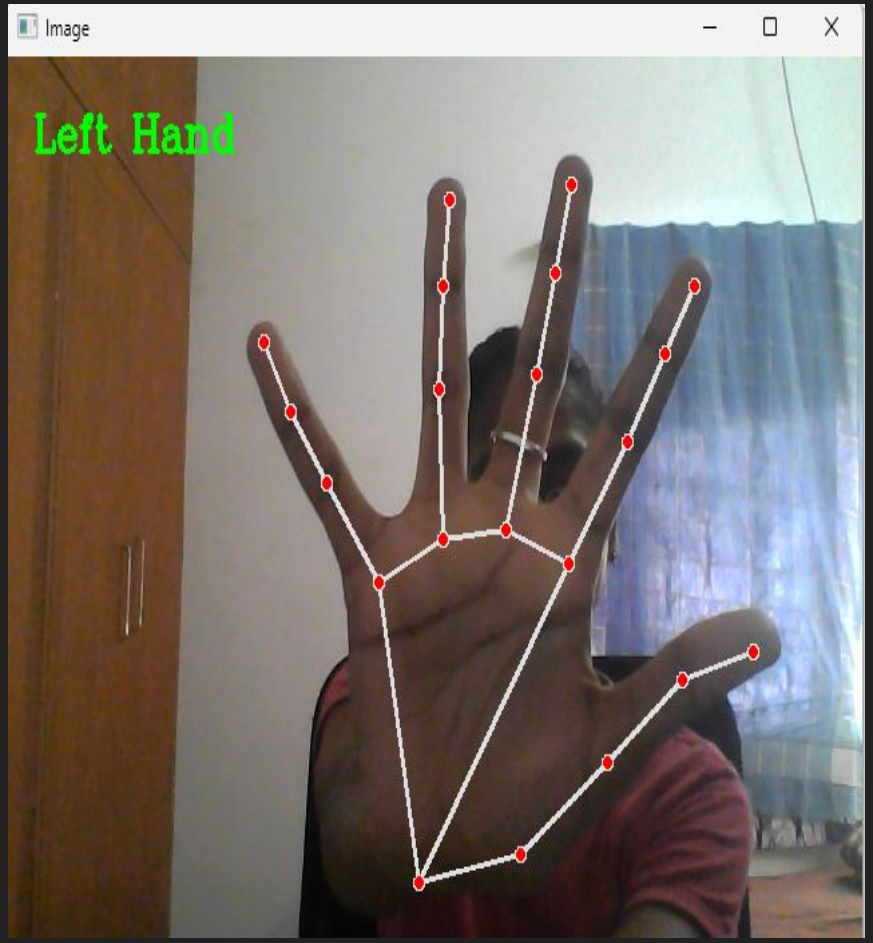
HAND LANDMARK DETECTION

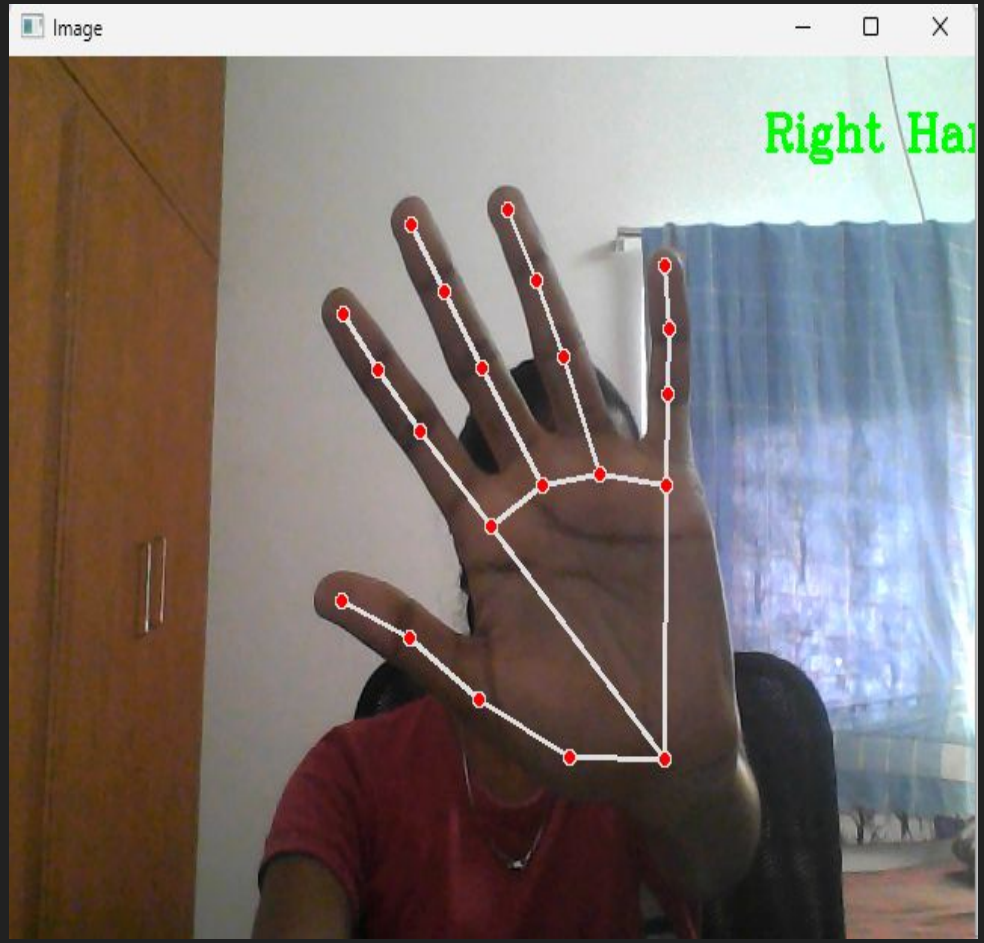
Detected 1 hand. Landmark table (normalized coords and pixel coords):

index	name	x_norm	y_norm	z_norm	x_px	y_px
0	WRIST	0.554120	0.954886	6.180887e-07	355	458
1	THUMB_CMC	0.455561	0.915270	-5.279522e-02	292	439
2	THUMB_MCP	0.390134	0.797939	-7.809708e-02	250	383
3	THUMB_IP	0.348054	0.692006	-9.652409e-02	223	332
4	THUMB_TIP	0.299305	0.622776	-1.156247e-01	192	299
5	INDEX_MCP	0.464693	0.639622	-5.886990e-02	297	307
6	INDEX_PIP	0.433893	0.501810	-9.539897e-02	278	241
7	INDEX_DIP	0.413951	0.406848	-1.237113e-01	265	195
8	INDEX_TIP	0.399850	0.326573	-1.454405e-01	256	157
9	MIDDLE_MCP	0.534970	0.624442	-6.081271e-02	342	300
10	MIDDLE_PIP	0.530918	0.474668	-9.341666e-02	340	228
11	MIDDLE_DIP	0.526489	0.374906	-1.226688e-01	337	180
12	MIDDLE_TIP	0.523000	0.286990	-1.440781e-01	335	138
13	RING_MCP	0.598913	0.649545	-6.836189e-02	383	312
14	RING_PIP	0.622261	0.502689	-1.102430e-01	398	241
15	RING_DIP	0.633769	0.404923	-1.404736e-01	406	194
16	RING_TIP	0.642523	0.317059	-1.603444e-01	411	152
17	PINKY_MCP	0.656314	0.704980	-7.897226e-02	420	338
18	PINKY_PIP	0.705678	0.608049	-1.236742e-01	452	292
19	PINKY_DIP	0.738519	0.545124	-1.446541e-01	473	262
20	PINKY_TIP	0.765746	0.485338	-1.567688e-01	490	233

Num landmarks: 21 (should be 21). Shape: (21, 3)

DETECTION OF LEFT AND RIGHT HAND LANDMARKS





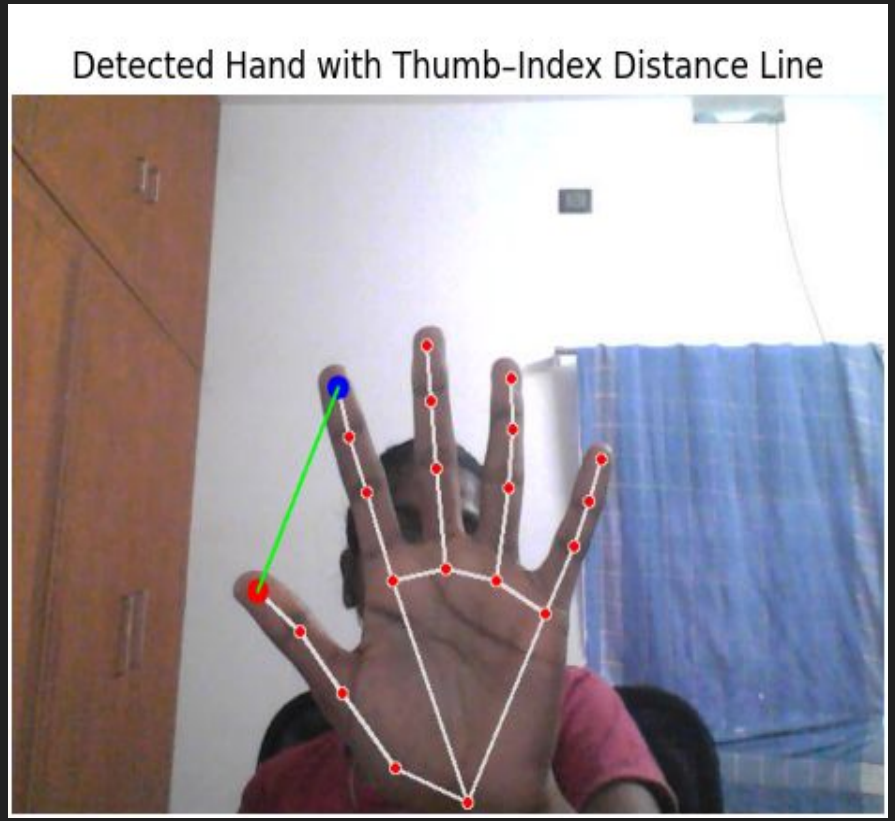
DISTANCE MEASUREMENT

MEASURING THE DISTANCE BETWEEN THUMB TIP AND INDEX TIP

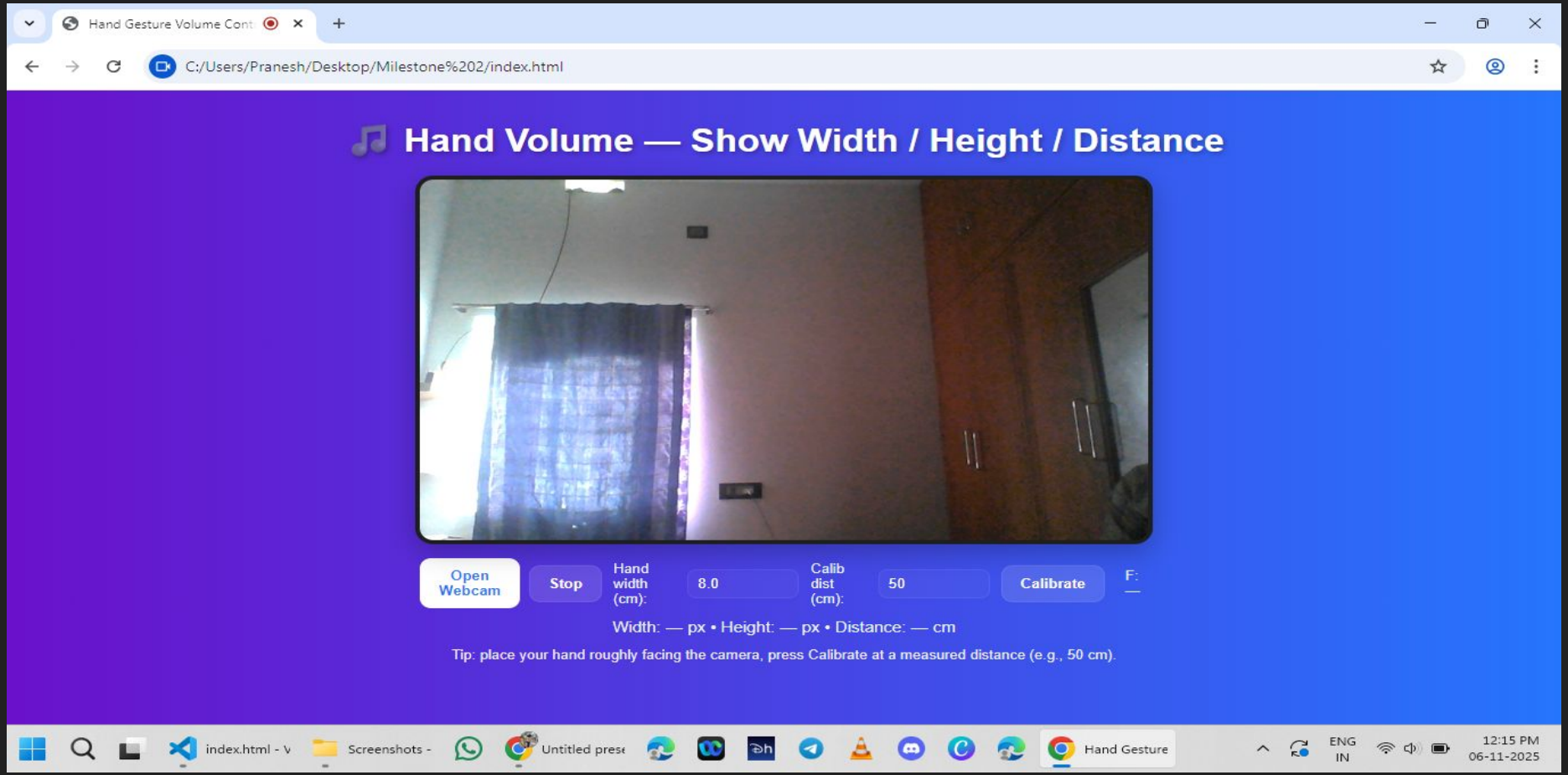
Detected one hand.

Distance between Thumb Tip (LM_4) and Index Tip (LM_8):
→ Normalized distance: 0.2991
→ Pixel distance: 148.25 pixels

index	name	x_norm	y_norm	z_norm	x_px	y_px
0	WRIST	0.522796	0.984778	5.183938e-07	334	472
1	THUMB_CMC	0.439653	0.936127	-3.573577e-02	281	449
2	THUMB_MCP	0.378545	0.831818	-5.123486e-02	242	399
3	THUMB_IP	0.330168	0.747781	-6.419992e-02	211	358
4	THUMB_TIP	0.282088	0.691129	-7.691474e-02	180	331
5	INDEX_MCP	0.436254	0.676321	-2.636856e-02	279	324
6	INDEX_PIP	0.406892	0.553711	-5.194459e-02	260	265
7	INDEX_DIP	0.386923	0.475478	-7.388296e-02	247	228
8	INDEX_TIP	0.373789	0.406797	-9.112826e-02	239	195
9	MIDDLE_MCP	0.496900	0.659095	-3.197040e-02	318	316
10	MIDDLE_PIP	0.486354	0.519131	-5.313477e-02	311	249
11	MIDDLE_DIP	0.480458	0.425768	-7.501764e-02	307	204
12	MIDDLE_TIP	0.475424	0.349776	-9.173921e-02	304	167
13	RING_MCP	0.555731	0.676380	-4.315696e-02	355	324
14	RING_PIP	0.569545	0.547274	-7.077733e-02	364	262
15	RING_DIP	0.573953	0.466067	-9.154706e-02	367	223
16	RING_TIP	0.573112	0.394419	-1.058495e-01	366	189
17	PINKY_MCP	0.611380	0.720948	-5.731023e-02	391	346
18	PINKY_PIP	0.643862	0.627795	-8.449315e-02	412	301
19	PINKY_DIP	0.662241	0.566177	-9.683561e-02	423	271
20	PINKY_TIP	0.675486	0.507273	-1.047014e-01	432	243



FRONTEND OF THE WEBCAM

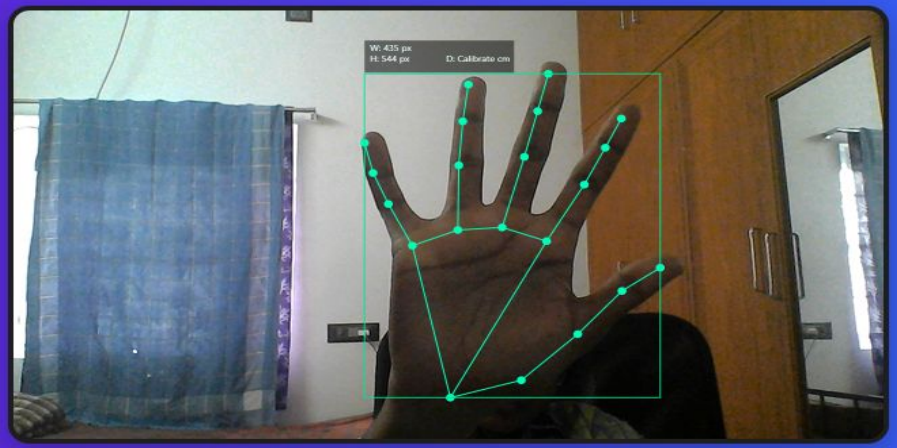


WIDTH , HEIGHT , DISTANCE

Hand Gesture Volume Cont

C:/Users/Pranesh/Desktop/Milestone%202/index.html

Hand Volume — Show Width / Height / Distance



Open Webcam | Stop | Hand width (cm): 8 | Calib dist (cm): 50 | Calibrate | F: —

Width: 435 px • Height: 544 px • Distance: Calibrate cm

Tip: place your hand roughly facing the camera, press Calibrate at a measured distance (e.g., 50 cm).

index.html - \ | Screenshots - | Write explana | Hand Gesture | ENG IN | 12:29 PM 06-11-2025

TECHNOLOGY USED:

HTML , CSS , JAVASCRIPT

HTML creates the basic structure of the webpage (like video display and buttons).

CSS styles the interface, making it look clean and organized.

JavaScript handles camera access, gesture detection, and distance measurement using libraries like MediaPipe

THANKYOU