TOUCH LESS COMPUTER INTERACTION AND USER IDENTIFICATION

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Abstract: Human-computer interaction (HCI) is a tendency in technology development that aims to improve the convenience and simplicity of our lives. A gesture recognition system is a suitable HCI solution in some situations where we cannot easily touch the equipment. One of the most natural human-machine interactions in software development has recently been hand gesture detection, especially for enabling flexible HCI. The development of a system that can be used to communicate with disabled people or to operate a device uses the gesture recognition method. HCI is used to speed up computations and make users more comfortable. Additionally, the brightness of the external display is also adjustable. In this project, authentication is provided using touchless control and face detection powered by deep neural networks.

Keywords: ***Face Detection, Volume Control, Brightness Control ,Gesture based, Cursor, Baum Welch, Control.***

I. INTRODUCTION

For the purpose of reducing the spread of germs, the environment of today needs less contact with frequently touched surfaces. Companies all over the world are integrating touchless technologies into their customer journeys to satisfy health and safety requirements as well as customer expectations.

Customers can interact with systems without touching them thanks to touchless technologies. Transactions can be carried out without the need for bodily contact using touchless interactions like gestures, object, facial, or voice detection, or conversational AI.

The spread of pathogens by contact has long been researched. The probability of touch-based transmission from interactive experiences is decreased, which helps allay customer concerns about touch-based germ exposure.The differentiation between touchless and contactless technologies is a crucial one to keep in mind. Users can communicate with systems using touchless technologies without using any physical input. For instance, a customer can choose a digital menu item using a voice command rather than a button click. Technologies that eliminate physical contact between individuals reduce it. Contactless technology is used when scanning a quick response (QR) code on a phone to make a transaction rather than giving a cashier a credit card.

The COVID-19 pandemic has accelerated the use of this technology due to hygiene standards, which is enabling the transition to Zero User Interface (UI). One way to describe Zero UI is as a controlled interface that allows for user interaction. Zero UI is being used on more and more devices. Natural interaction techniques like speech or gestures are included in these control interfaces. Touchless Operation Contactless access control is a vital component of this decentralisation of workplace systems. Key cards and biometric authentication are the two mainstays of workplace access management. A switch to touchless technology for access is unavoidable if more frictionless, secure, and intelligent access management are to be achieved.

Section 2 explains the literature review, Section 3 discusses methods, Section 4 discusses the experimental results and analysis, Section 5 discusses conclusion, and Section 6 discusses references.

II. Literature Survey

The author's description for classification and gesture detection in [1], an artificial neural network application is utilised. Gesture recognition is processed twice in order to save memory and minimise computational costs. To attain real-time performance, these systems' difficult issues must be background invariant, lighting insensitive, and person and camera independent.

Introducing J. Jabez. Utilizing ultrasound technology, distance measurements are obtained in [2]. The specific distances determine the tasks that are accomplished. With this innovative method, gestures are suggested, actions are detected by sensors, and then actions are carried out in response to the user's instructions.

Summary by the author In[3] Finding and identifying the hand in real-time webcam video is the first step in any hand processing system. The technical word for this is hand gesture detection. Detecting a hand may be challenging due to the wide variety of position, orientation, placement, and size. The changing lighting conditions in the area also contribute to variation. Often, there are several stages involved in identifying hand gestures, such as image acquisition, image pre-processing, feature extraction, and gesture recognition.

The Dzib library is used in this face recognition, according to Priyanka Chilap in [4], to build us with technology through speech, gestures, hand interaction, eye tracking, and biometrics like facial recognition and contactless fingerprinting. For tasks like facial recognition, picture editing, and other image and video analysis, OpenCV is used. Smart appliances, smart TVs, smart assistants, and consumer robotics all use face embedding for the actual identification process. Waste during normal class

participation is reduced thanks to this face detection. A system that features potent integrated computers, quick RAM, and excellent live stream capture can be enhanced.

The writer of In[5] introduces the face detection algorithm known as HOG (Histogram Oriented Gradient). The HOG face detector uses an unusual approach to identify faces: a rotating detection window that revolves around the image and is used for object identification. Although the HOG SVM algorithm runs more slowly than the Maan cascade algorithm, its output is more precise. It depends on an object's capacity to have a distribution of intensity gradients, which is determined by the fundamental unit of the imaging system.

In order to enhance the real time cursor control system using static gestures, a hand gesture image detection method based on PHOG (Pyramid Histogram of Oriented Gradient) and an improved LBP and KNN was developed in [6]. This involved testing six distinct gestures fifty times f rom various angles. The features are identified and extracted using PHOG, and the local binary pattern is then used to extract additional features. Gesture detection is then implemented using KNN classification.

To perform the required actions on the operating system's cursor function, [7] uses the single shot multi Box Detector (SSD), an architecture of convolutional neural networks with some libraries of computer vision like Open CV, machine learning framework Py Torch. SSD was chosen for this implementation because it is much faster than competing techniques, has high accuracy, and can generate 46 frames per second.

Implementing the system for hand gesture recognition system for controlling UI, which is a standalone application for controlling different user interface controls like controlling the application of VLC video player and controlling Microsoft Power Point with hand gestures?

III. Methodology

3.1Changing the volume with a hand gesture:

The operational flow map is shown in Fig. 3.1. Start the programme first, then import the various modules needed for AI recognition and the various audio utilities that are the primary focus. The area of interest is then captured by different contours being detected.

Later, it runs the circle to find different hand landmarks. The distance between the thumb and the tip of the index finger is measured after the hand land lines. The frame, which uses AI, displays the reading's final values along with a full volume rise and decrease. The programme runs until the loop has completed its iterations. As soon as the repetitions are finished, the programme ends and the loop is broken.

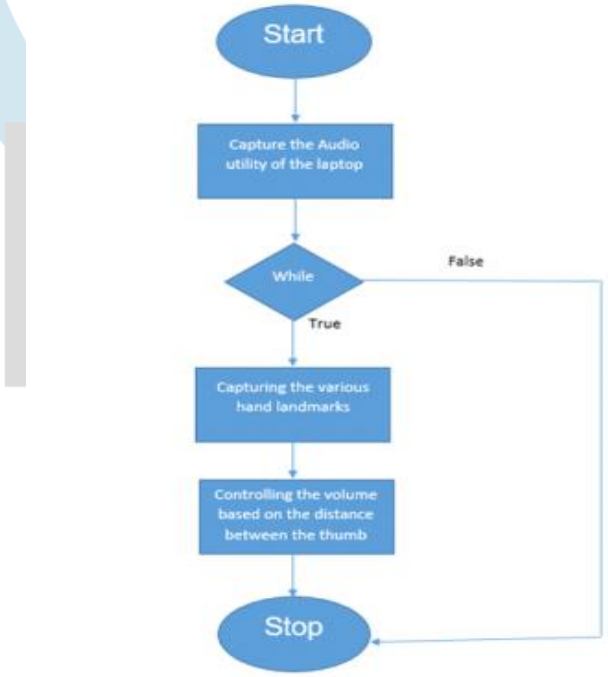

Fig 3.1:Volume control flowchart using hand gestures.

3.2Hand-controlled-ai-virtual-mouse-master :

The flowchart of the real-time AI virtual mouse system in Figure 3.2 explains the different conditions and functions used in the system.

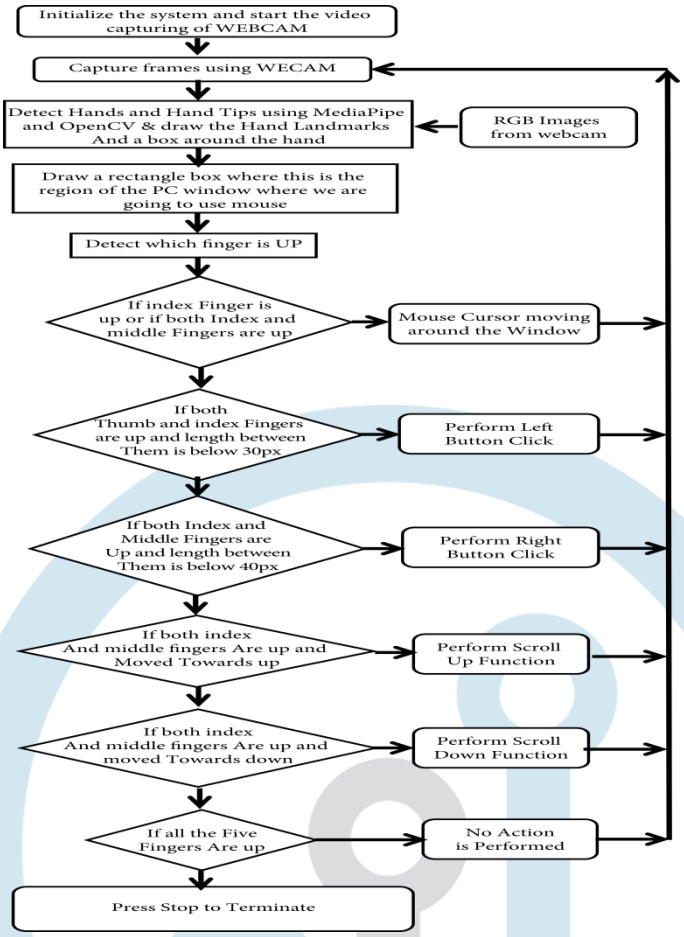

Fig3.2:Real-time AI virtual mouse device flowchart.

3.3 A GUI app for facial detection :

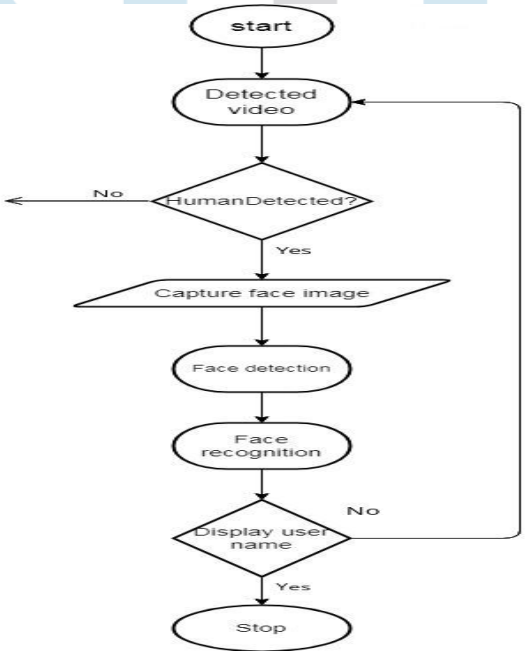

Fig3.3:flowchart for the facial recognition GUI app master.

3.4:Using hand gesture algorithms, volume control:

Step 1: Check for the camera.
Step 2: Detects Hand or Finger.
Step3: Complete the initialization Configuration of Hands
Step 4: The Speaker access through the library pyrantels.
Step 5: Until the Camera is open.

• Camera works to capture an image.
• Convert to" RGB".
• Collection of gesture information.
• Complete the image processing, through the process method.

Step 6: The Camera will be closed then the process will stop.
Step 7: Stop.

3.5Algorithms for Hand-Controlled AI Virtual Mouse Masters:

Step 1: Check for the camera.
Step 2: Capture the Frame from the web camera.
Step 3: Then process the captured frame from the webcam.
Step 4: Now, Detect Hands & Hand tips using "Media pipe & Open cv".
Step 5: Then detect which finger is up.
Step 6: If the index and middle finger are up, then it should be in moving mode.
It goes to step 7.
Step 7: If all fingers are up, then neutral gesture.
It goes to step 8.
Step 8: If only the middle finger is up, then the left click.
It goes to step 9.
Step 9: If only the index finger is up, then right-click.
It goes to step 10.
Step 10: If the thumb & index fingertip is closer like pending then if moving in an upward direction then it includes increases in the volume.
If moving in the downward direction, then decreases the volume.
Step 11: If the distance b/w index & middle finger is short, then it is double-clicked.
Step 12: Display.
Step 13: Stop the execution.

3.6 Algorithms for a GUI app for facial detection:

Step 1: Starts.
Step 2: Turn on video Capture.
Step 3: Identifying Human.
Step 4: Human Detected.
Again go to register/add a user.
Step 5: If Face is captured.
Step 6: Then click on the trained model.
Step 7: Then the face is detected & recognized.
Step 8: After this display username.
Go to step 2.
Step 9: Stop.

IV. 0045xperimental Results And Analysis

4.1Changing the volume with a hand gesture:

In this project, we are using python technology to develop the project. The code is written and designed in python language using Opencv and NumPy modules. In this project firstly we import the libraries which are to be used for further processing the input and the output. The libraries which are used in this project which need to be imported are OpenCV, media pipe, math, types, pycaw, and NumPy. We get video input from our primary camera. Now, here media pipe is used to detect the video as input from our camera and use a hand. hands module to detect the gesture. Then, to access the speaker, we used the paw and provided the range of the volume from minimum volume to maximum volume. The next step is to convert the input image to an RGB image to complete the processing of the input captured. Then it's turned to specify the points of thumb in input and fingers. The volume range is processed using the hand range in this process NumPy is used to convert this process and process the required output. NumPy package is a fundamental package for computing in Python language. It is consisting of several things-

- powerful N-dimensional array
- object broadcasting
- tools to integrate C
- Fourier transform, and random number capabilities.

A. OPEN CV: OpenCV is a library of python that tackles PC vision issues. It is used to detect the face which is done using machine learning. It is an especially important library and is used in several projects to detect the face and recognize several frames also it supports several programming languages. It also performs object detection and motion detection. It also supports several types of operating systems and can be used to detect the face of animals also.

B. NUMPY: NumPy is the module of Python. The NumPy word shows Numerical Python, and it is utilized. This is the module that is written in c language and is said to be an expansion module. NumPy guarantees remarkable execution speed. NumPy is mostly used for performing calculations, and tasks using certain functions it provides like multiply, divide, power, etc.

C. IMAGE FILTERING –HISTOGRAM: Histogram is a type of graph that represents the movement of the pixel power in the portrayal. In this, we filter the images using a histogram and convert them into RGB to process the image in our system. Consequently, the power of a pixel is in the range [0,255].

D. MEDIA PIPE: Media Pipe is a module for processing video, audio, and several types of related data across platforms like Android, iOS, web, edge device, and several applied ML pipelines. Several types of functions are performed with the help of this module, we have used this module in our project to recognize the hand gesture and detect the input from them.

- Face Detection.
- Multi-hand Tracking.
- Segmentation.
- Object Detection and Tracking.

4.2Hand-controlled-ai-virtual-mouse-master:

Firstly, we need to import the required libraries for the program like Speech Recognition, Gesture Controller, Pyn put, patagium, Wikipedia, OpenCV-python, media pipe, ctypes, Com types, pycaw,screen-brightness-control, eel, Web browser, DateTime, math, Os, etc.

CAMERA: Based on the frames captured by a laptop or PC's webcam, the proposed AI virtual mouse system works. As a result of using the Python computer vision library OpenCV, the video capture object is created, and the webcam will begin to capture video. The webcam then captures the frames and passes them to the AI virtual machine.

VIDEO CAPTURE: A webcam is used for the AI virtual mouse system, which captures every frame until the program is closed. Following is the code that finds the hands in the video frame by frame by converting the BGR frame to the RGB frame of the video. Defines a function called MP hands that will help us track the position of our hands. Detecting Which Finger is up and our job at this point is to detect which finger movements and the respective coordinates of the fingers are up based on the information found in the library and perform the mouse function accordingly. This stage involves maintaining which finger is up based on the tip Id we found using the Media Pipe as well as their respective coordinates and then performing the appropriate mouse function accordingly. It sets up a loop that will track the position of our hands every 0.1 seconds. Mouse Features Using Computer Vision to Determine Hand Gestures and Hand Tip Detection Cursor Moving: The mouse pointer is made to travel across the computer's window using the Python Autopsy package when the index and middle fingers are up for the Moving Function. The Hand Reco class is initialized with the Hand Label of the person's right hand. The initialize_hand_result method is called to initialize the hand result with the first frame's landmark points. This method is called when the optical flow is complete. The update_hand_result function checks to see if the hand is moving, and if so, returns a None with the Gesture. MOVING.

If the hand is not moving, then the landmark points are checked for a known gesture. The function then checks to see if the gesture has changed. If it has, it updates the current gesture and increments the gesture frame count. Theget_signed_dist method returns a signed distance in pixels between two landmark points. The get_dist method returns the normal Euclidean distance between two landmark points.

Left Button Click: Left button click is made possible by wide opening the index finger and dragging it onto the file or folder.

Right Button Click: Wide opening the middle finger and dragging it onto the file or folder to explore more activities on it enables right button to click.

Scroll Up/Down: The computer is designed to accomplish the mouse operation of scrolling up and down by merely

Scroll Up/Down: The computer is designed to accomplish the mouse operation of scrolling up and down by merely pinching, which is done by connecting the tips of the index and middle fingers to the screen's scroll bar.

4.2.1The AI-Powered Virtual Mouse System's Camera

Real-time detection and identification of a hand or wrist is accomplished using a single-shot detector model. The MediaPipe uses the single-shot detector approach. Because it is simpler to train palms, the hand recognition module first trains a model for palm detection. Additionally, small objects like palms or fists respond considerably better to the nonmaximum suppression [13]. As shown in Figure 4.2.1, a model of hand landmark entails finding 21 joint or knuckle coordinates in the hand area.

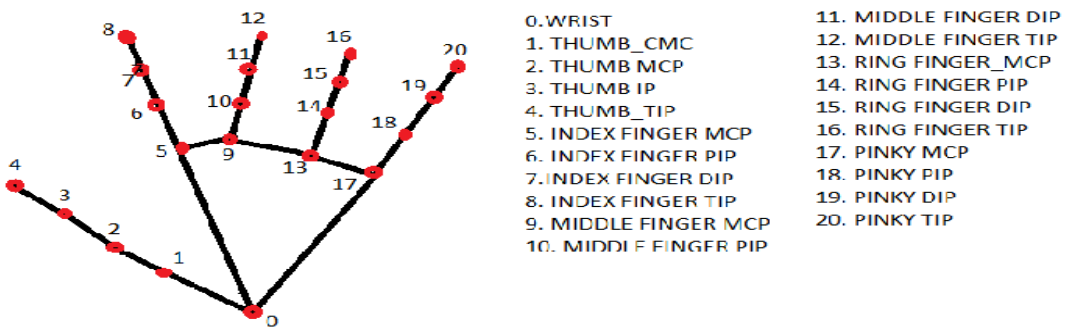

Fig4.2.1

4.2.2 Processing and Recording the Video

The webcam is used by the AI virtual mouse system to record each frame until the programme is finished. As shown in the following code, the video frames are converted from BGR to RGB in order to identify the hands in the video frame by frame.
findHands: define(self, img, render = True)
cv2.cvtColor(img, cv2.COLOR_BGR2RGB) imgRGB
self.results = self.hands.process(imgRGB)

4.3Changing the volume with a hand gesture:

In this paper, we primarily concentrated on hand landmark detection and video camera. After that, we can access the system's audio features, and the level will change depending on how far apart our thumb and index finger are from one another. With the help of the OpenCV library and the Python computer language, we wrote the code for this AI application. The basic idea behind this computation is to cycle each edge while using the live feed from the camera.Nevertheless, the calculated ROI (area of interest) will be used for execution.
The average volume detected when the thumb and index finger are closest to one another is depicted in the image below.

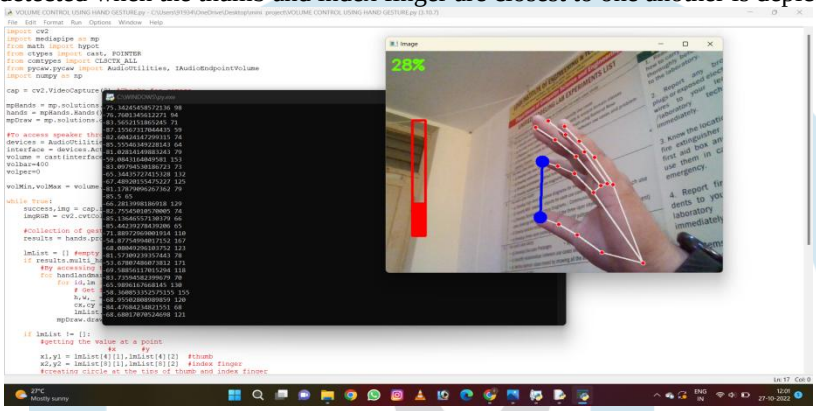

Fig 1: Minimum volume

When the thumb and index finger are in close proximity to one another, the average volume detection is depicted in the image below.

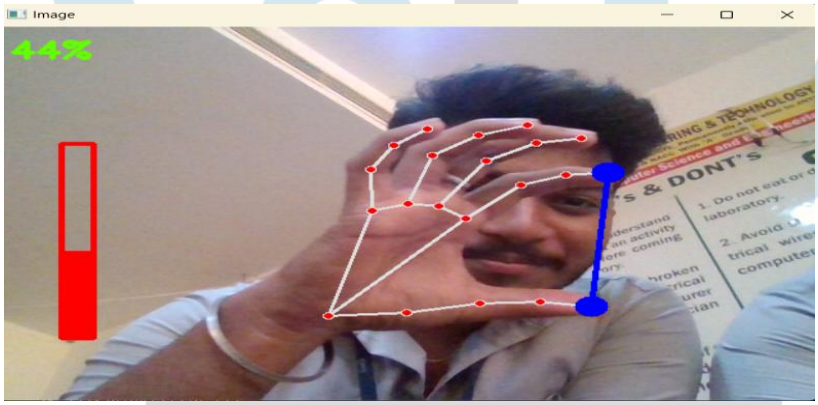

Fig 2:Moderate volume

The maximum volume detection when the thumb and index finger are separated from one another is depicted in the image below.

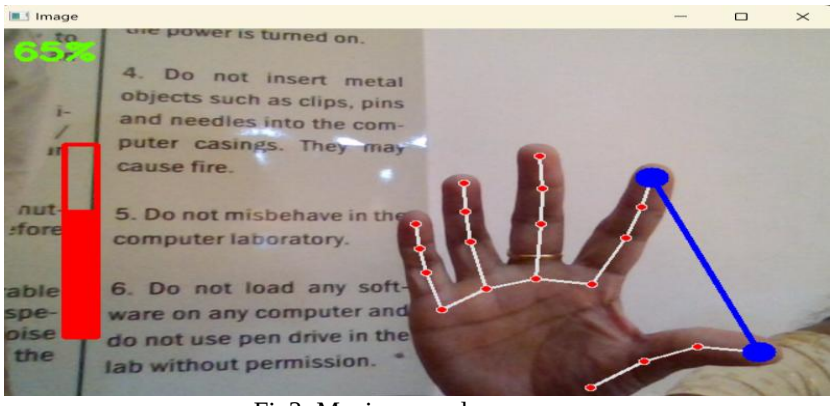

Fig3: Maximum volume

4.4 Hand Gestures and Computer Vision-Based Hand Tip Detection for Mouse Functions Depending on the Hand Gestures

4.4.1. For the Computer Window's Mouse Cursor to Move

The Python AutoPy module can be used to move the mouse cursor around the computer window if the index finger is up with tip Id = 1 or both the index finger and middle finger are up with tip Id = 1 and 2, as shown in Figure 4.

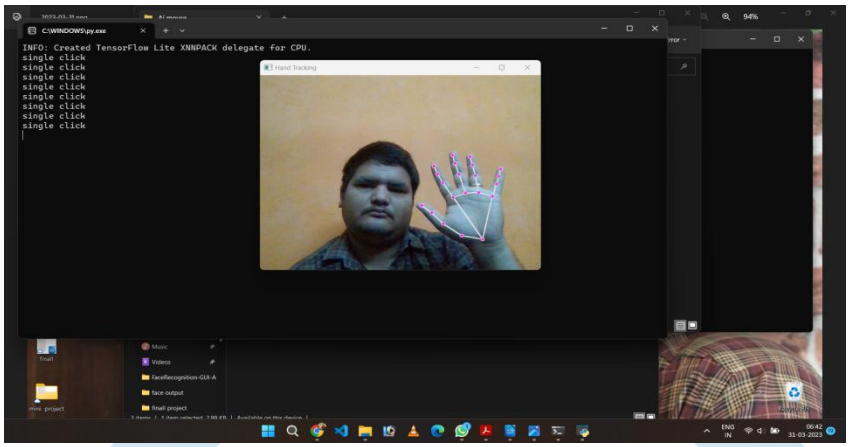

Fig 4: The computer display is being moved by the mouse cursor.

4.4.2. For the Mouse to Click with the Left Button

The pynput Python package is used to programme the computer to execute the left mouse button click if the thumb finger with tip Id = 0 and the index finger with tip Id = 1 are both up and the space between the two fingers is less than 30px, as shown in Figures 5 and 6.

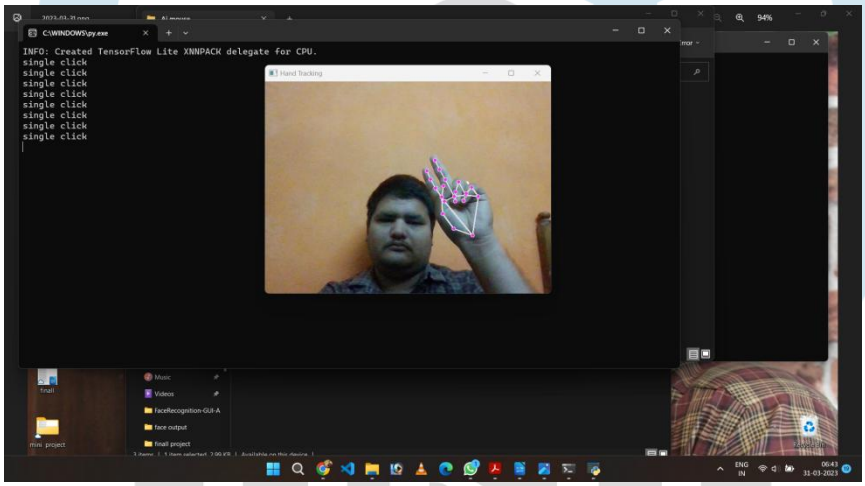

Fig 5:Make a gesture to make the computer hit the left mouse button.

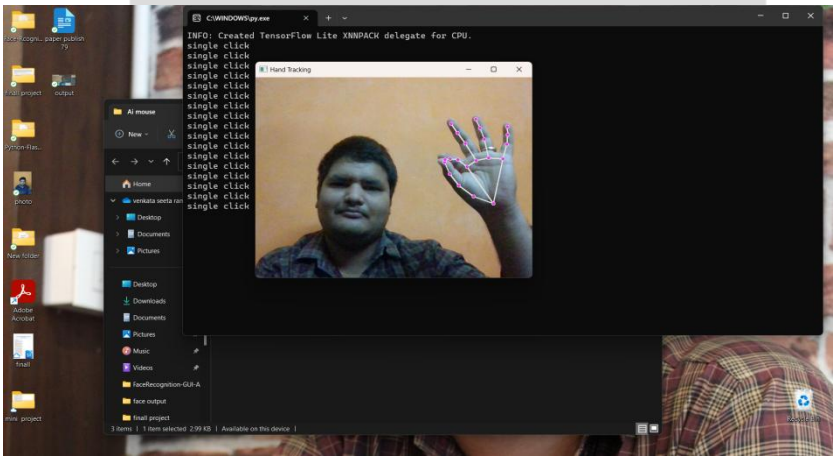

Fig 6: Make a gesture to make the computer hit the left mouse button.

4.4.3. For the Right Button to Be Clicked by the Mouse

The pynput Python package is used to programme the computer to execute the right mouse button click if the middle finger with tip Id = 2 and the index finger with tip Id = 1 are both up and the space between the two fingers is less than 40 px, as shown in Figure 7.

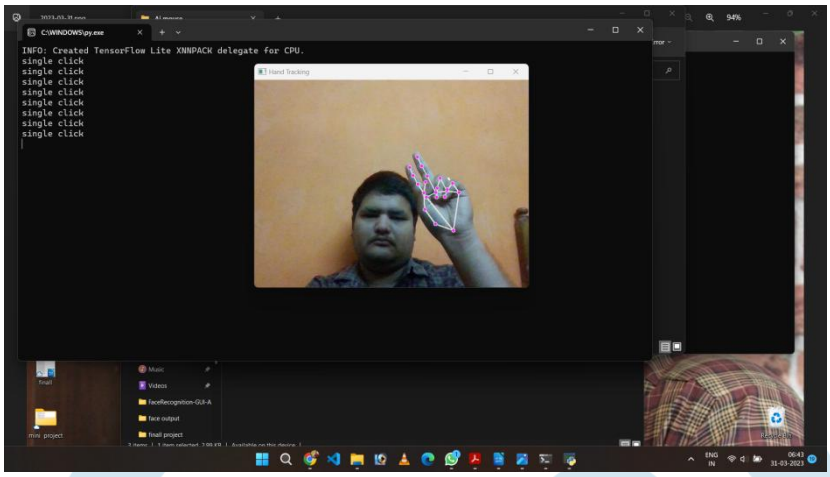

Fig 7: Make a right button click gesture to instruct the machine to do so.

4.4.4. For the Screen to remain Motionless.

As shown in Figure 8, the computer is programmed to stop performing any mouse actions on the screen if all fingers are up and tip Id = 0, 1, 2, 3, and 4. Figure 8.

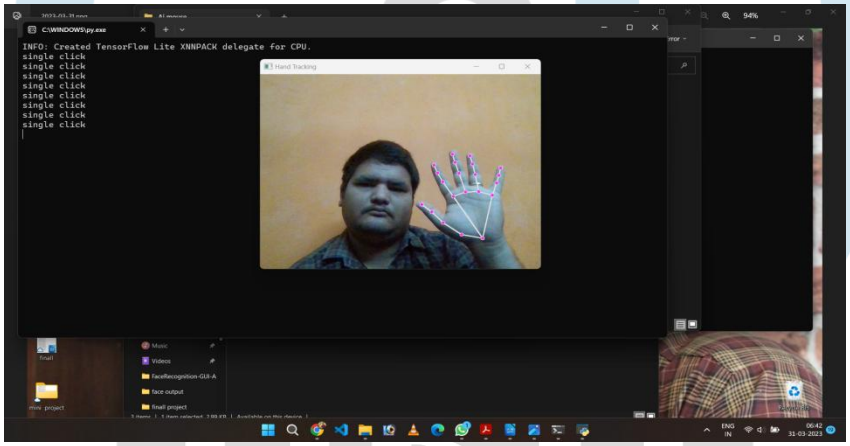

Fig 8: Gesture for the computer to perform no action.

4.5 A GUI app for facial detection

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Fig 9: Home page

4.5.1Add the user whose classification you want to teach.

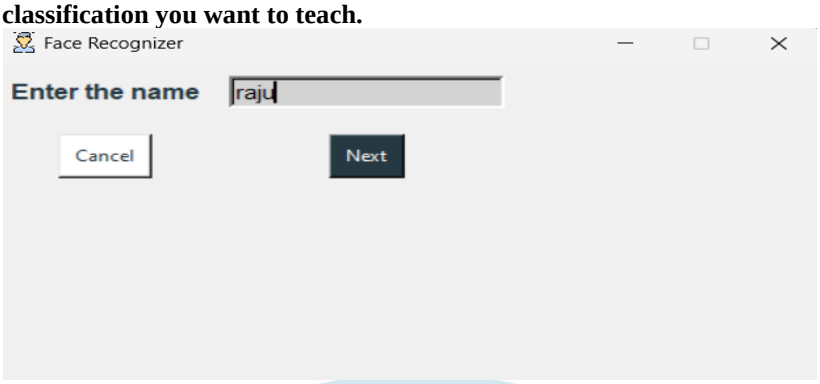

Fig 10: Add the user you want to train a classifier for

4.5.2Data from the visage is captured, then the classifier is trained.

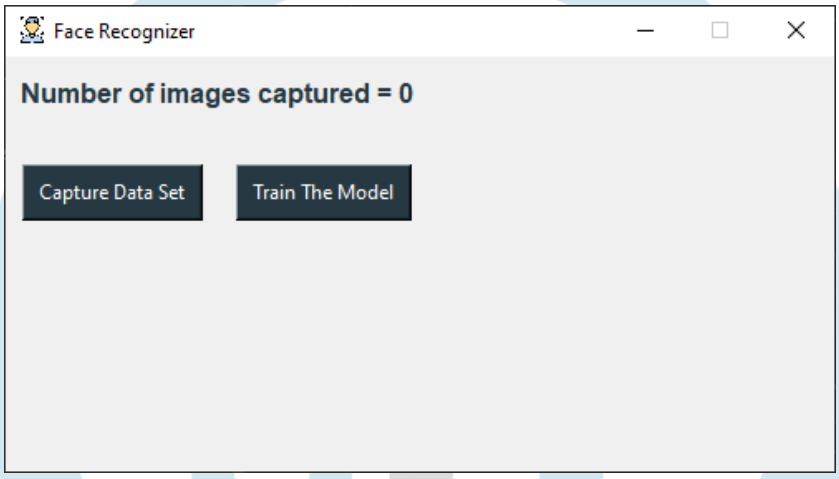

Fig 11: Capture data from the face then train the classifier

4.5.3Users catalog

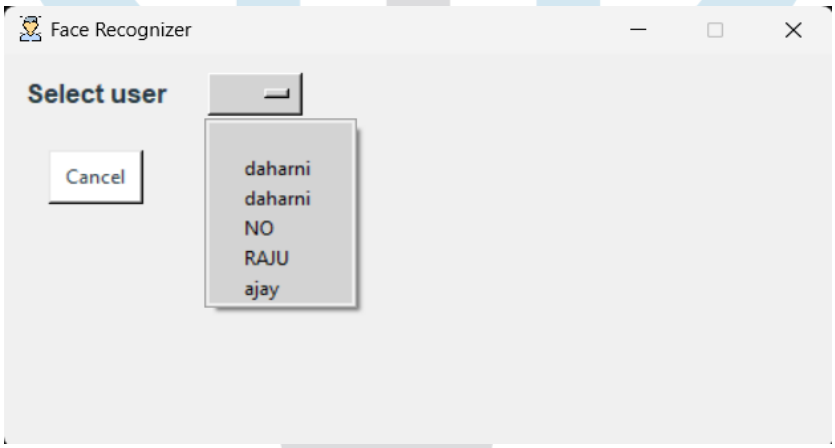

Fig 12:A List of every member

4.5.4: Recognition

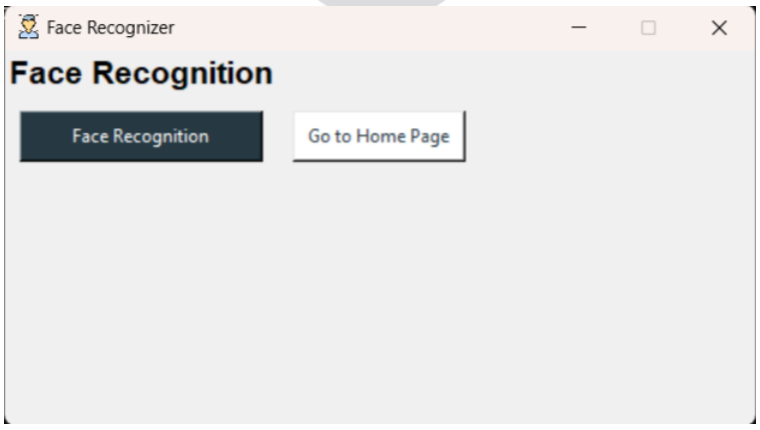

Fig 13:A webcam window will popup and start recognition proccess

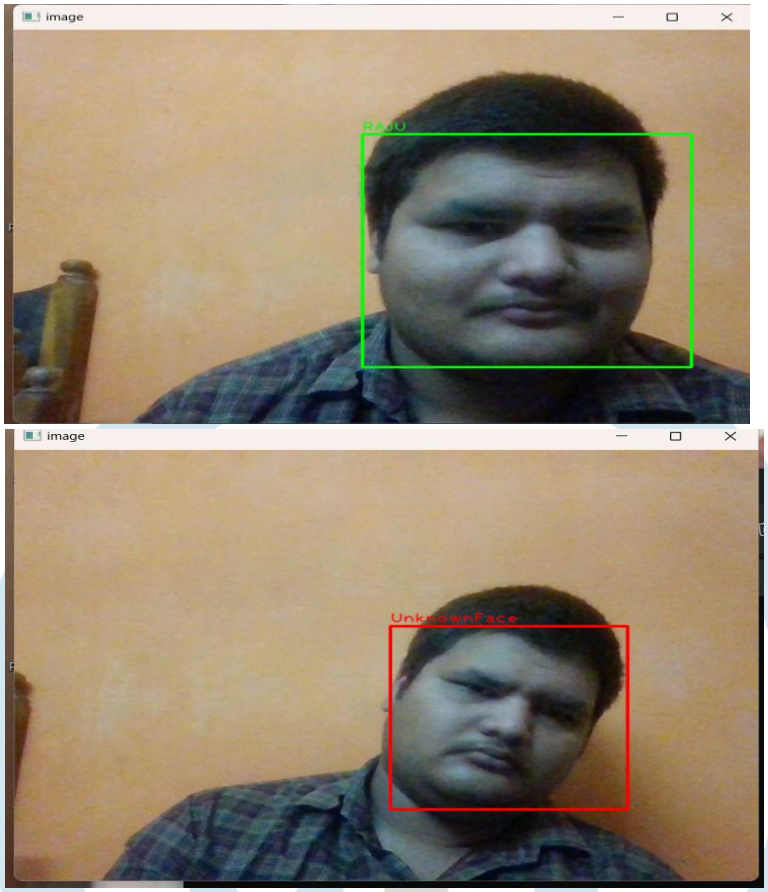

Fig 14: ultimate results for facial recognition

V. Conclusions

This project is presenting an interface that allows the user to perform hand gestures for convenient and easier way to control the software. A gesture-based volume controller does not require some specific type of markers, and these can be operated in our real life on simple Personal Computers with a very low-cost cameras as this not requires very high-definition cameras to detect or record the hand gestures. Specifically, the system tracks the tip positions of the counters and index finger of each hand. The main motive of this type of system is to automate the things in our system to make the things easier to control. So, to make it reliable we have used this system to make the system easier to control with the help of these applications. The proposed method here successfully developed a hand gesture volume control, which can manipulate (max to min) with gesture is performed by the person and accordingly perform the functionality associate with its accuracy.

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