

Virtual Mouse Using Hand Gesture Recognition

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Abstract -

The Mouse is a great invention of technology. In recent years, different types of the mouse have been invented. There are many types of mouse available Optical Mouse, Wireless Mouse, and Bluetooth Mouse. However, hardware devices are used in this mouse, and also expensive because some mouse they used sensors. This proposed system is based on the latest technology which used hand gestures. Hand gestures are captured with the help of a camera and after that hand landmark key points are detected and according to a particular gesture is recognized and it performs various operations of the mouse cursor. Users can perform various operations of the mouse without using any hardware devices or sensors only required your hand with the help of your fingers you can perform mouse operations. and it is user-friendly also, cost-effective.

Keywords: Hand gesture, hand landmark key points, user friendly. Cost-effective

1. INTRODUCTION

a virtual mouse is a device used for to perform the operations of mouse cursor , using hand gesture recognition. Hand gestures are the most effortless and natural way of communication. perform the various operation of the mouse cursor. Instead of using more expensive sensors, a simple web camera can identify the hand gesture and perform the action. It helps the user to interact with a computer without any physical hardware device to control mouse operation. The Convolutional Neural Network is used in this model to recognize various features of an image or video frame. It accepts video data as input, and according to the gesture recognition performs the particular task of the mouse cursor. The utilization of virtual mouse appears in space-saving situations or movement situations.

2. Literature Survey

Sr. no	Research paper	Technology	Advantage	Limitations
1	Virtual Mouse Control Using Colored Fingertips and Hand Gesture Recognition 11-12 Sep 2020 V.Reddy T.Dhyanchand,G.Krishn,S.Maheshwaram	Hand Gesture Recogniti on, IP, Neural Network, Python, OpenCV, pyautogui	used neural network for hand gesture recognition.	Limitation of This Mouse they used Colored Fingertips
2	Virtual Mouse Implementati on Using Opencv, 2019 Sai Varun. I Puneeth, Dr.T.Prem Jacobi	Opencv, IP, Deep Learning, Pyautogui , NumPy, Anaconda	used python for hand gesture recognition.	In this, they used color variation techniques , it's very complex to use
3	Hand Gesture - Virtual Mouse For Human- Computer Interaction , 2018 S.Mohammed , V.H Preetha	Matlab s/w, Two cameras,	Get 90% Correct Detection for both views, under enough Light Condition	used two cameras that's why its expansive and costly.

4	Virtual Mouse 12 th March 2015. A.mhetar,B.K Srioop, Kavya AGS, Ramanath Nayak, Ravi Kumar	IR Camera, USB- HID, IR Pen, Teensy(AR M M4)	its works as a virtual marker, it's effective to use while teaching.	They used Hardware devices, and the Cost of this is More,
5	Virtual Mouse Using Object Tracking 10th July 2020 M.Shetty, C.Daniel, M.BhatkarOf rin Lopes	HSV Technique, Python, Opencv, Ip	Accuracy of this System is in Plain Background: 95%	Non- Plain Background : 40%
6	Design and Development of Hand Gesture based Virtual Mouse 19 Dec 2019 K.Shibly, Samrat Dey, A.Islam, S.Showrav	HCI Technology	use of the latest technology.	In this System barrier is the lightning Condition that's why system still not enough to replace the mouse.

3. Existing System

It consists of the simple mouse operations Using the colored fingertips. This system divided into two methods finger detection using colored fingertips and gesture recognition, As shown in below figure.

It used video interface processing the image by background subtraction. They used colored finger caps for finger detection, after that color identification will be done then circle identification will be formed on number of fingers.it will recognize the gesture according to it will perform various operations of the mouse.

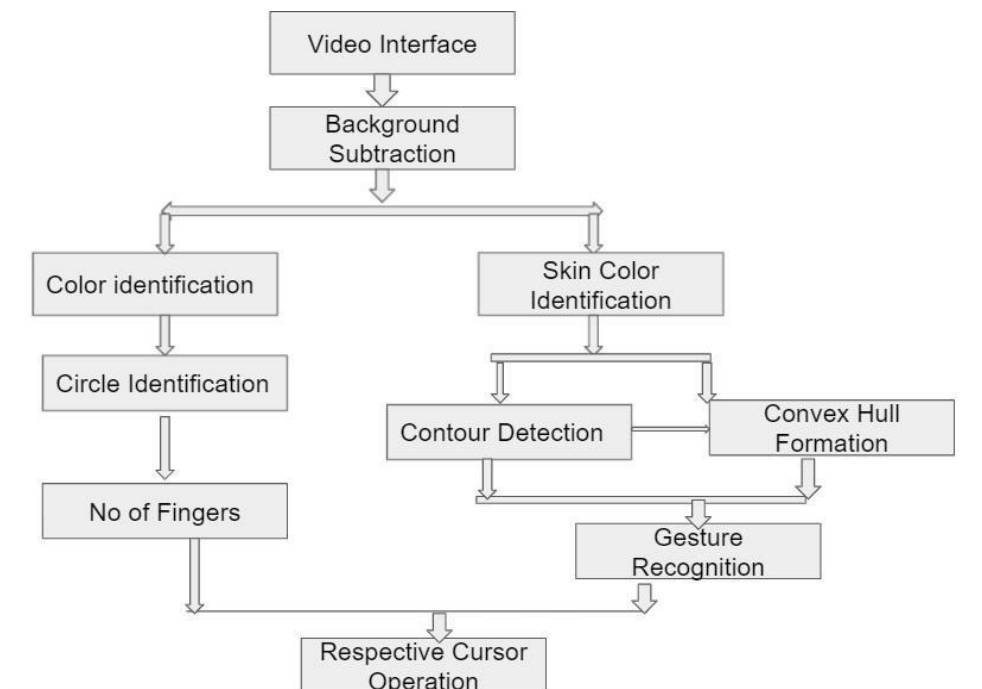


Fig 1: Existing System of Virtual Mouse Control using Colored Fingertips and Hand Gestures Recognition [1]

4. Proposed system

To design a virtual mouse without any hardware devices and colored fingertips. instead of using more expensive extra camera, we used the web camera of our device, for capturing the live feed through the web camera.

Flow of the virtual mouse system is firstly video interface will start using the web camera. Then it recognize the hand gestures and control the mouse interaction then perform the various operations of the mouse cursor.

This virtual mouse is a portable, user friendly, and cost is less.

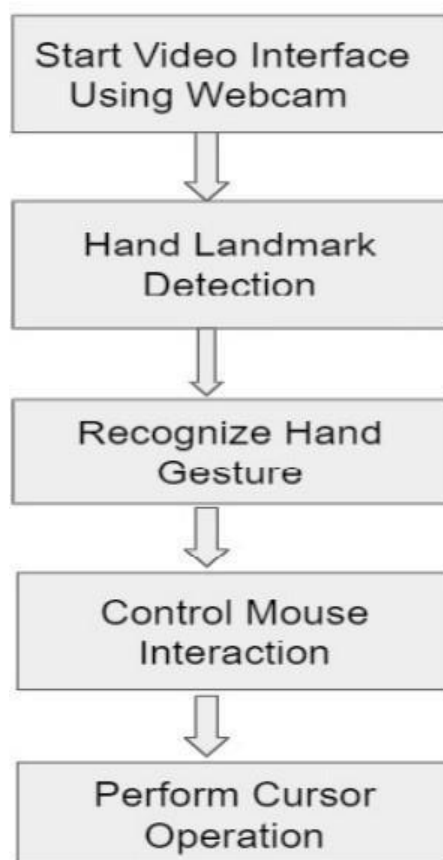


Fig 2 : Proposed system of virtual mouse using hand gesture recognition

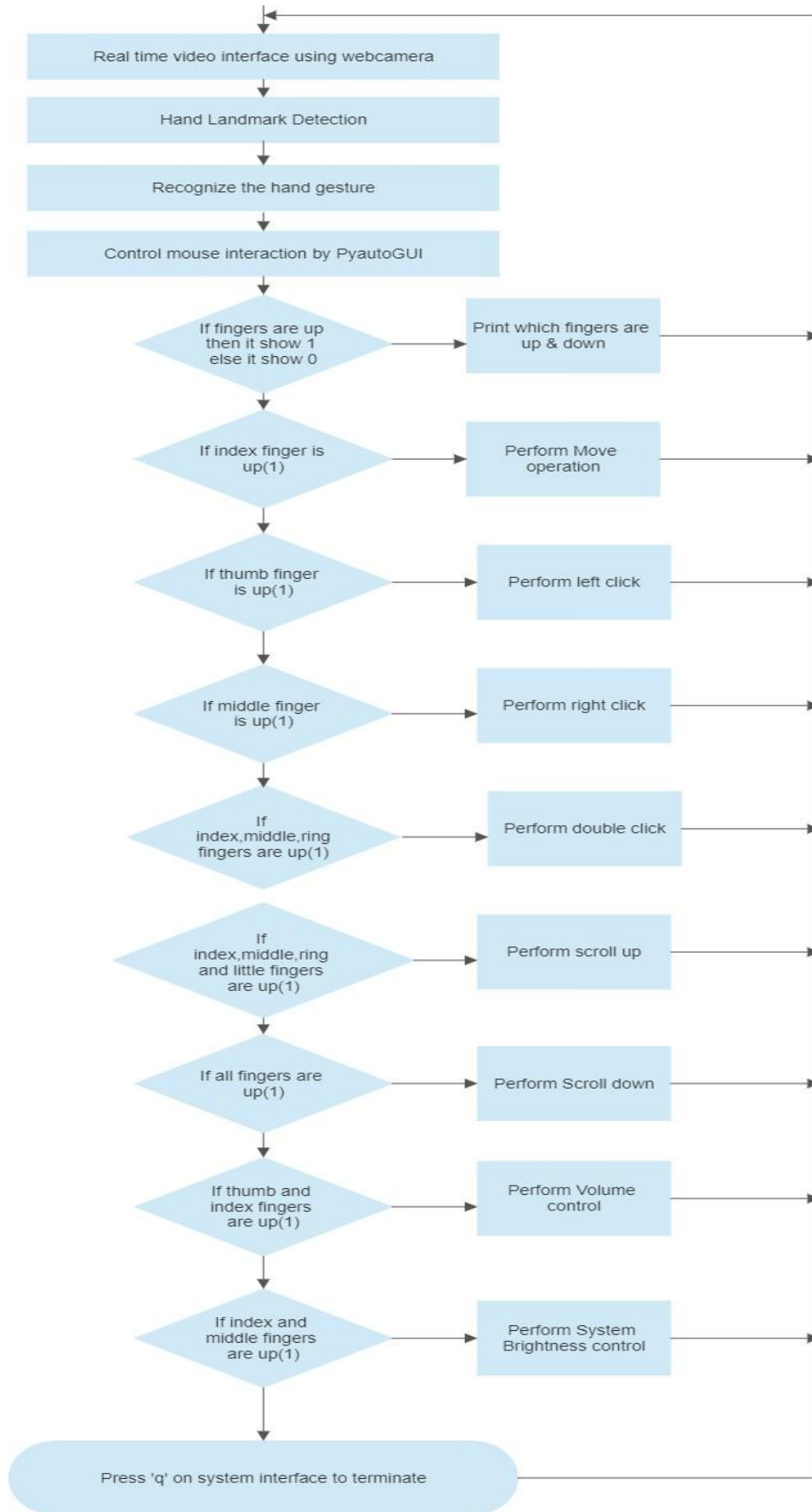


Fig-3: Flowchart of the real-time Virtual mouse using hand gesture recognition

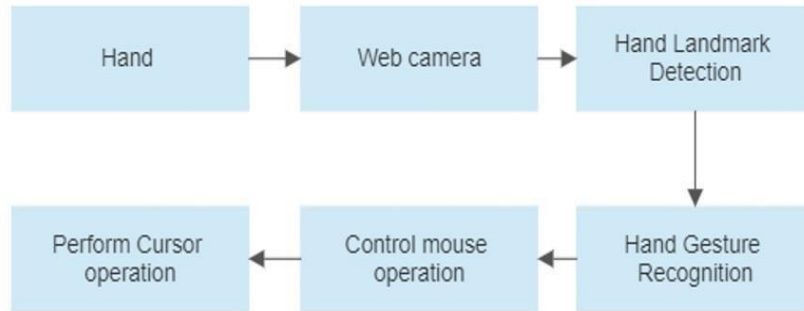


Fig-4: Block Diagram of Virtual Mouse using hand gesture recognition

4. Methodology steps :

1. It will detect the camera, video interface will be started.
2. The camera can extract and recognize human hand gestures from a video interface.
3. Hand tracking functionality is done by using media pipe.
4. After the recognition the cursor moves accordingly, to perform various operations.



Fig 4.1 Hand Key Points [7]

4.1 Classification Model

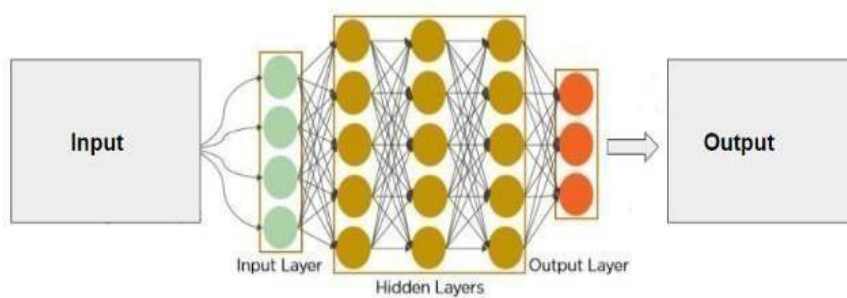


Fig-4.1.1: Convolution Neural Network [8]

- To recognize various features of an image or video frame CNN makes use of layers.
- Cnn used layers to detect the features of the input image.
- And apply convolution to each feature detection, and get the recognized output image.

4.2 Libraries are Used :

1. Mediapipe: Hand Tracking functionality is done by using a media pipe.
2. Numpy: It provides a multidimensional array object and tools for working with these arrays
3. Open CV: this is used mainly for real- time computer vision.
4. Pycaw : it is used for audio utilities.
5. Pyautogui: Pyautogui keeps the python scripts and controlsthe mouse and keyboard to automate interactions with other applications.
6. Screen Brightness Control: it is used o control system brightness of your system.

5. Implementation

We used one hand fingers to do this mouse operation. Hand gestures are input data and performing various mouse operations according to the hand gesture are output data. hand landmark detection is done by media pipe. Using pyautogui we perform the mouse operations like Right Click, Left Click, Double Click, Move, Scroll Up, Scroll Down.

the camera captured the live feed data using open cv and its input data. we used pyautogui which allows the mouse cursor to move and controls the mouse operation interaction with hardware. Pycaw is used for audio utilities. We performed volume control for that we used the Pycaw library.to perform volume control we calculate the distance between the index tip and thumb tip. For system brightness control we used the screen brightness-control library. In this operation, we track all points on the hand and detects hand landmark, calculating the distance between the index tip and middle fingertip with brightness range.

We declare variables in that we can make the connection between each finger. We created the function of hand landmarks and other functions for fingers. if the finger is up then it's 1, if the finger is down then it's 0. Using this we give conditions to perform mouse operations. We used different combinations of fingers to perform mouse operations.

Fingers use for mouse operations are :

1. Hand Landmark detection: It detects the hand with 21 hand key points. It prints which fingers are up(1) and down(0)
2. Move: perform move operation using Index Finger.
3. Left Click: perform left-click operation using Thumb Finger.
4. Right Click: perform right-click operation using Middle Finger.
5. Double Click: perform a double click operation using three fingers, fingers are index finger, middle finger, ring finger.
6. Volume control: perform volume control using the thumb and index finger.
7. Scroll up: perform scroll operation using the index finger, middle finger, little finger, ring finger.
8. Scroll down: perform a scroll down operation using all fingers.
9. Screen Brightness Control: We used the index and middle fingers to adjust the system brightness

5.1 Result and Outputs:

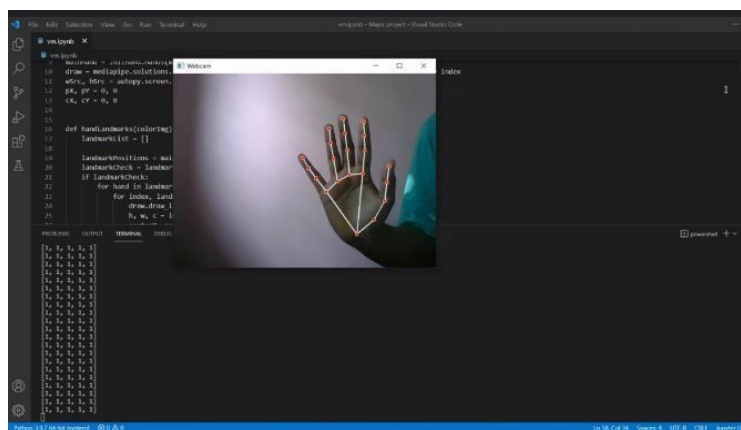


Fig- 5.1.1: Hand Landmark Detection(Performing which fingers are up and down)

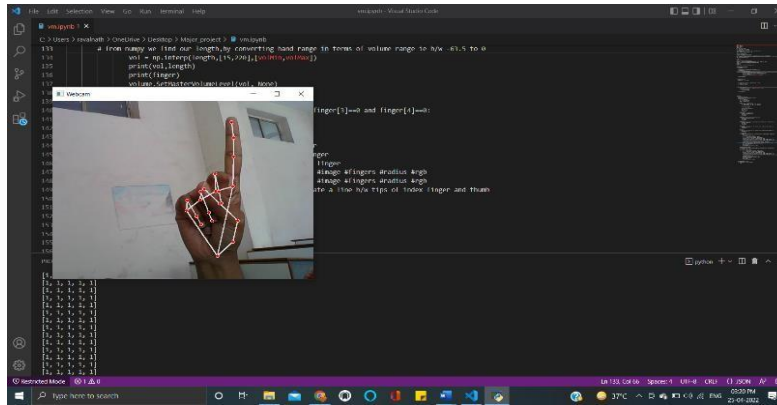


Fig- 5.1.2: Cursor Move (Moving the cursor using index finger)

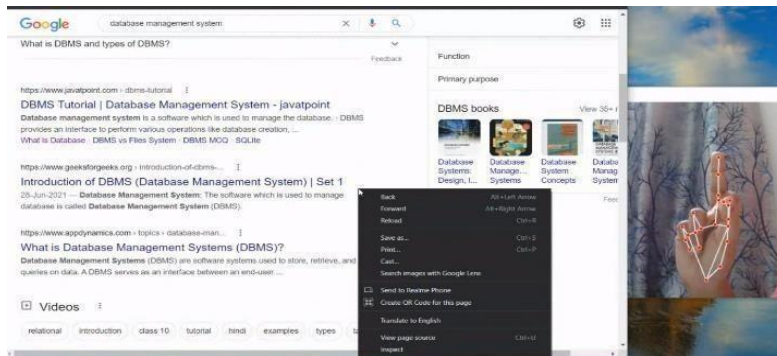


Fig- 5.1.3: Right Click (Right-click performed by middle finger)

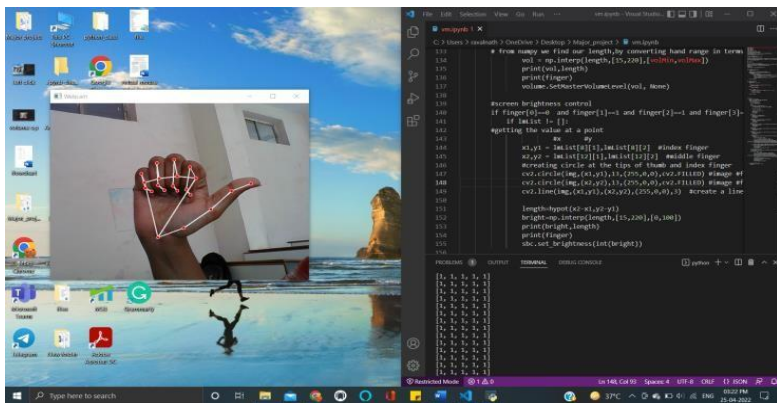


Fig- 5.1.4: Left Click (Left Click performed by thumb finger)

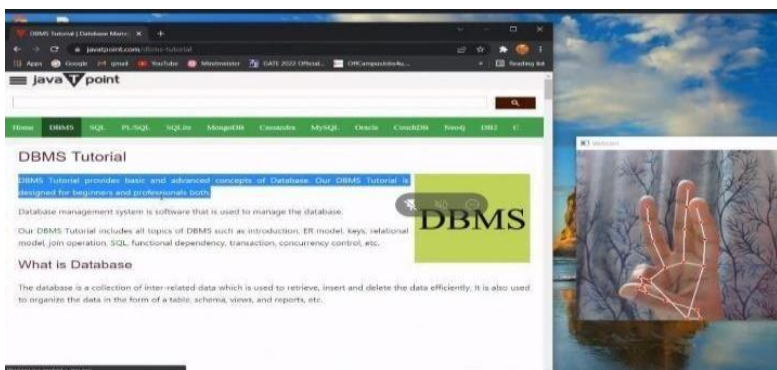


Fig- 5.1.5 Double Click (Double click performed by index, middle and ring fingers)

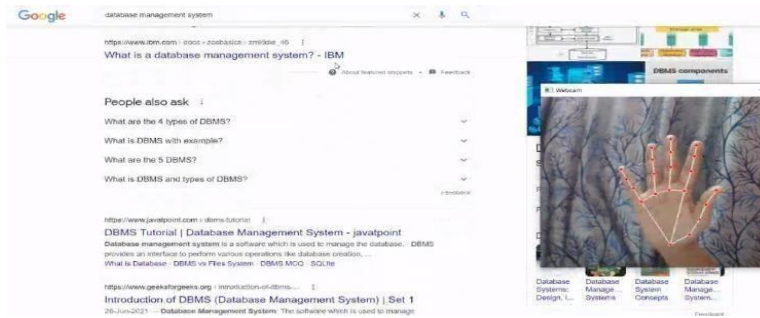


Fig- 5.1.6: Scroll Down (scroll down implemented by the thumb to the little finger)

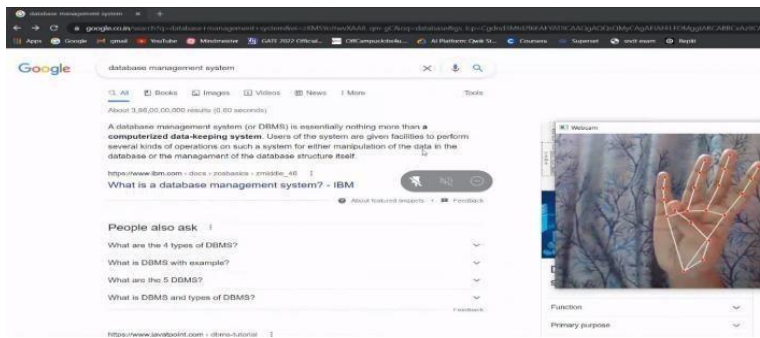


Fig- 5.1.7: Scroll Up (Scroll up performed by the index finger, middle finger, little finger, ring finger)

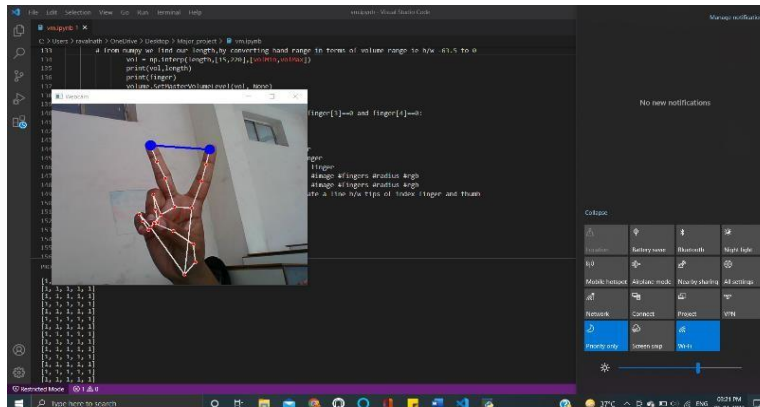


Fig- 5.1.8 Brightness Control (System Brightness Control done by index and middle)

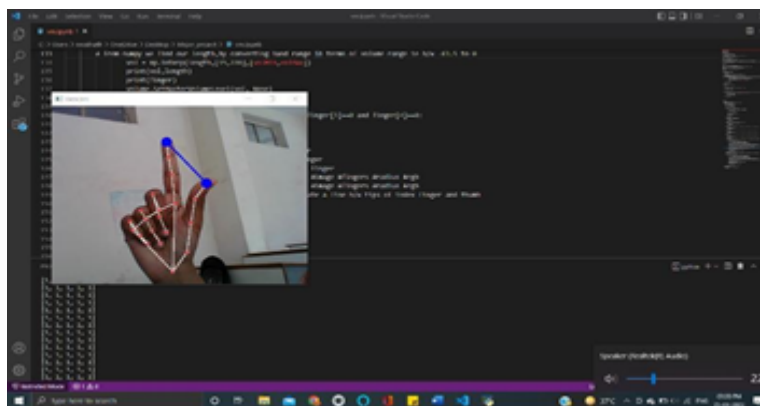


Fig - 5.1.9 Volume Control (volume control done by thumb finger and index finger)

6. CONCLUSION

The Virtual Mouse system development is user- friendly and used in real-time. This system is cost- effective and easy to use. The main objective of developing a virtual mouse is to control the mouse cursor functions by using hand gestures instead of using a physical mouse and any other hardware devices.

The virtual mouse will be used in real-world applications, and also, it can be used to reduce the spread of COVID-

19. since the mouse system can be used virtually using hand gestures without using the traditional physical mouse. we can conclude that the virtual mouse system has performed very well without any hardware devices. This virtual mouse system overcome most of the limitations of the existing systems

7. Acknowledgement

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8. REFERENCES

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