International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 968-972 www.ijaem.net ISSN: 2395-5252

AI Based Virtual Mouse.

Sanjay B. Dhaigude, Muskan N. Mulla, Swapnali D. Jadhav, Keeratkaur S. Chadha, Nikita S. Dharangutte, Aarti A. Shingade

Associate Professor in Electronics, Dept. of Electronics Engg., Sangli(MS)-India
Dept. of Electronics, Walchand College of Engineering, Sangli(MS)-India
Dept. of Electronics, Walchand College of Engineering, Sangli(MS)-India
Dept. of Electronics, Walchand College of Engineering, Sangli(MS)-India
Dept. of Electronics, Walchand College of Engineering, Sangli(MS)-India
Dept. of Electronics, Walchand College of Engineering, Sangli(MS)-India

Submitted: 01-06-2022 Revised: 10-06-2022 Accepted: 15-06-2022

ABSTRACT:
A hand gestures detection system and volume control is a non verbal communication technique. We can make use of the machine learning algorithm which is used in this system. The accuracy of the system totally depends on the webcam of the user's laptop. This detection system presents a method of detection and controlling volume.
This system takes images by using a camera and processes the images taken by a person to make them easier to track and after that detection of a variety of images taken by users and performs the various functions of the mouse.

I. INTRODUCTION

With the growing importance of computers in daily life people's ideas are making their use easier and easier because of its ability to cooperate among humans and Pc's. In this project we are using two libraries.So this work represents the control of the volume system with the help of this hand gesture recogniser system. By using this detection system, a person can easily set the volume of the volume of the computer without using any kind of hardware that is doing all activities virtually. The output of this gesture, the volume control system is a simple computer vision application recently developed to capture and recognize simple hand landmarks to control the volume of the system by using a tracking module by hand.It is easy to accurately increase or decrease the volume and mouse functions using a hand.

II. LITERATURE REVIEW

The objective of our project is to develop an AI based Virtual Mouse application which helps in the development in a few sectors. We are aiming to eliminate the need of the physical mouse and make it interact with the computer with the help of the computer's camera.

Many researchers have developed many techniques related to virtual mouse and all have different techniques.An approach, by Erdem is to, cause the track with the help of fingerprint to control its motion. When the hand of the user passed over an area, then the click of the mouse used to occur.

ChuFeng Lien developed another approach to control the mouse cursor and by using the fingers-tips movement ,we can cause a click to occur.Image density phenomenon depends on the clicking method by holding the mouse cursor for a specific time period.

Apart from this one method was used by Paul et al. He used the idea that when you move the motion from thumbs-up position to fist then a click occurs.When we make a special sign the mouse pointer will move.

The current system is either wireless or wired by making use of gestures to monitor the system. It even depends on colored fingers which senses the colour like red, green and blue to perform various operations of the mouse ,but it is not flexible as coloured fingers are not practically possible every time.

By referring to all these techniques we are now designing a system that will recognise gestures through open computer vision.We will track the image of the gesture with the help of a webcam and then certain actions according to the gesture will be carried out.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 968-972 www.ijaem.net ISSN: 2395-5252

III. METHODOLOGY

The method proposed in the paper is established on the phases that are Webcam Input is taken by camera module, frame detection and recognized gesture extraction is represented in fig 3.1.

The following steps are included to develop the algorithm:-

(i) The initial step is to capture the image using the webcam. (ii) The camera then extracts and recognizes the hand from the image that is inputted. (iii) Then the position of the hand is stored using the regular" coordinate-system" in the system.

(iv)By identifying which fingers are in use the operation of left click, right click or cursor moving along with the volume increase and decrease can be performed. Everything can be done by bare hands not accessories required and can be done by anyone.

(v)Correspondingly the operation is performed anywhere visible on the screen.

Fig.1. Block Diagram of the System

III.1 Image Acquisition

The proposed AI based Virtual mouse system captures the image taken by webcam in computer in the form of framesOpenCV which is the python computer vision library captures the video and then the capturing of video will be made by the webcam. The captured image from the webcam captures and passes the frames to AI virtual mouse.

The user's hand is pointed towards the camera or webcam and it captures the video that is extracted as input.The extracted video is then converted to images.On the basis of camera quality and the speed of capturing the images extracted per second is referred as Frames per second.The rate at which frames known as consecutive images appear in a display is called as Frames per second

Formula to calculate Frames per second is,

$$Fps = 1 / (CT - PT)$$

where , CT is the current time and PT is the previous time.

III.2 Landmark detection of hand

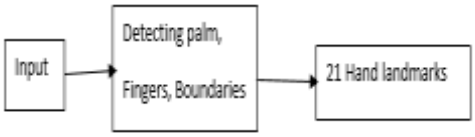


Fig.2. Landmark detection of hand

The next process in this system is landmark detection of the hand. This module is for calibrating hand gestures to the associated action. The input video captured by the webcam. For the virtual mouse the system uses the media pipe. Media pipe is free and open source. Landmark detection is an available feature. The module cv2 is also used, this module permits us to read an image and display it. In this block the system detects the 21 landmarks on the hand shown to the webcam. The 21 landmarks for hand are shown in the fig 3.3.

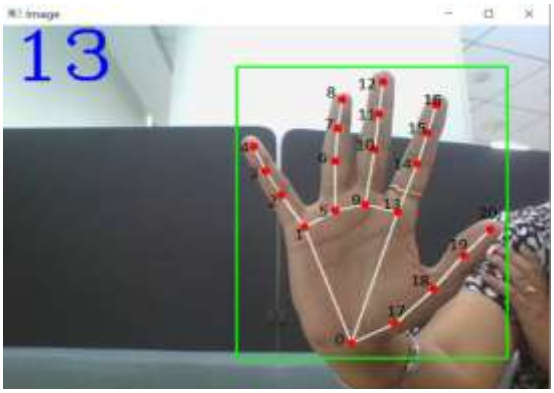
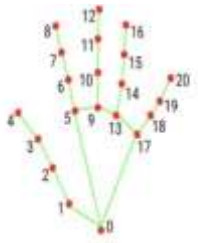


Fig.3. Hand Landmarks



0. Wrist
1. Thumb carpometacarpal joint
2. Thumb metacarpophalangeal joint
3. Thumb interphalangeal joint
4. Thumb tip
5. Index finger metacarpophalangeal joint
6. Index finger proximal interphalangeal joint
7. Index finger distal interphalangeal joint
8. Index finger tip
9. Middle finger metacarpophalangeal joint
10. Middle finger proximal interphalangeal joint
11. Middle finger distal interphalangeal joint
12. Middle finger tip
13. Ring finger metacarpophalangeal joint
14. Ring finger proximal interphalangeal joint
15. Ring finger distal interphalangeal joint
16. Ring finger tip
17. Little finger metacarpophalangeal joint
18. Little finger proximal interphalangeal joint
19. Little finger distal interphalangeal joint
20. Little finger tip

Fig.4. 21 3D landmarks

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 968-972 www.ijaem.net ISSN: 2395-5252

Above are the 21 hand landmark names. Detection of 21 landmarks per hand.

III.3 Extracting the feature

After detection of the 21 hand landmarks it keeps on focusing on particular hands and localizes the same hand until it loses track of that hand which can be beneficial when we have to detect the hand live stream or videos.

Minimum detection confidence is the next step that provides us the flexibility of how much rigidity we want from our detection module and in that case it provides the threshold value. The ideal range of this detection is [0.0,1.0] and by default, it remains 0.5 which means that if the confidence level drops below 50% then the hand will not be detected at all. 0.5 is the default value of minimum tracking confidence. If the value of tracking becomes less than the default value, then the module starts the detection. When the detection and tracking is done, then the data which were collected is then converted into the array and given to the user. There are 3 arrays in this system: lmList, list of X-Y and finger counts.

III.4 Virtual Mouse

The objective of this AI based virtual mouse is to develop a hand gesture control mouse which performs the mouse functionality. This can be done using the PC/laptop's webcam that first captures the hand and performs the mouse functionalities like moving the cursor, left click, right click and volume increase/decrease. The detected images classify the gestures. The lmList and x-y list are tracked to to control the cursor functionality. The AI, virtual mouse is the system and in this system the functions that are added are moving the cursor, right click, double clicking, left click, selecting text.

III.5 Gesture based Volume Control

In volume control, numpy is used for additional support for large, multi-dimensional arrays. Media pipe used to infer 21 3D hand information from just one frame. After detecting hand landmarks, the distance between tip of thumb and tip of index finger were calculated. Map the spacing between the thumb and the forefinger (index finger), to increase/decrease the volume.
Spacing between forefinger (index finger) and thumb is < 55=> volume decreased.
Spacing between forefinger (index finger) and thumb is >65=> volume increased.
When the person performs this volume control function and expands the fingers or contract, then the distance is calculated between 2 fingers and respective action takes place..

IV. RESULTS AND DISCUSSION

The spacing between the thumb and forefinger (index finger) can define the mode in which the volume is increasing or decreasing. If the spacing between the thumb and forefinger (index finger) landmarks is less than 55 then the volume decreases. This is the case in Volume Down.

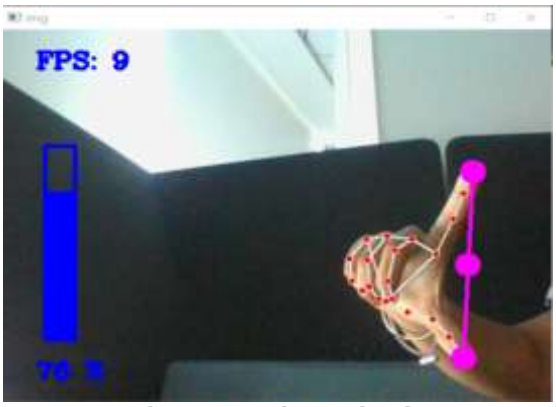


Fig.5. Volume Control using hand gestures (Volume up)

If the spacing between thumb and forefinger (index finger)landmarks is more than 65 then the volume increases. This is the case in Volume Up.

The Hand tracking module allows us to keep track of hand movement and each time it detects the orientation of the hand. Because of this functionality it is used in Gesture Based Volume control. To get the processed information and for operating on data Gesture Based Volume control is used.

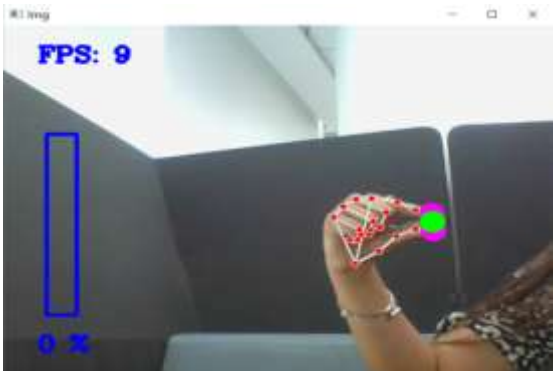


Fig.6. Gesture Based Volume Control (Decreasing Mode)

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 968-972 www.ijaem.net ISSN: 2395-5252

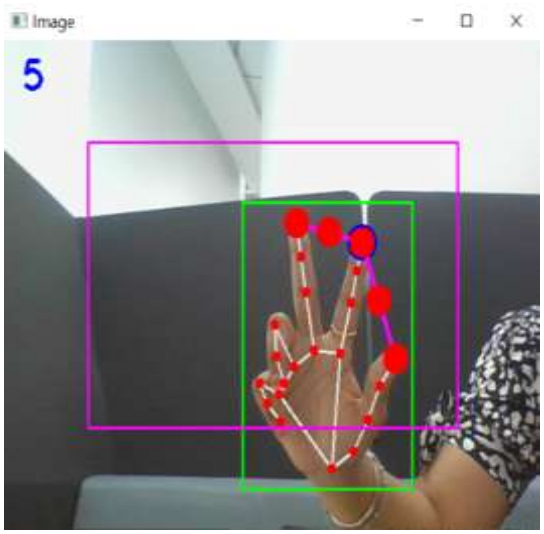


Fig.7. Cursor Moving

Fig 7 represents cursor moving functionality.

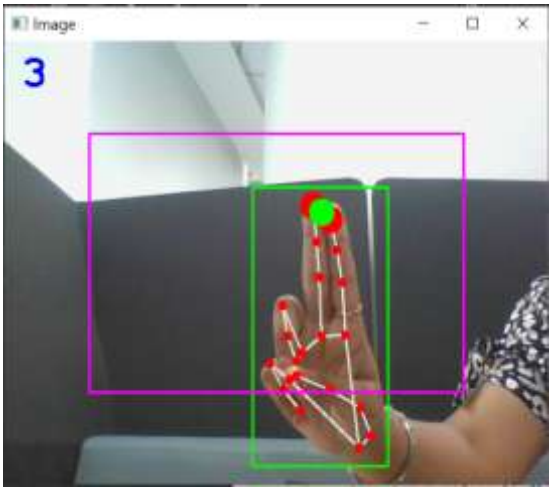


Fig.8.Left Click

For moving the cursor on the screen we can use the thumb, forefinger(index finger), and middle finger. when all the three fingers are up then it is the gesture for moving the cursor. Cursor movement is based on hand movement and smoothing ratio.
For left-click, as shown in fig 8 we can use the forefinger(index finger) and middle finger. This is used for double-click gestures.
.
Fig 9 shows a right-click. We can use our thumb and middle finger for right-click.

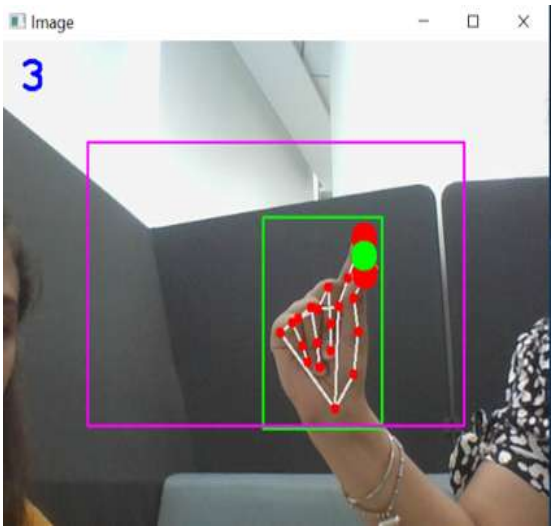


Fig.9. Right click

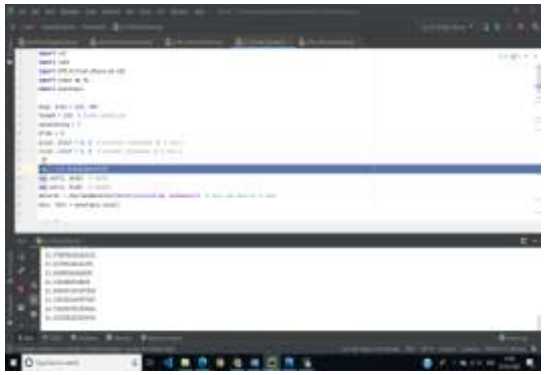


Fig.10. Text selected using double click

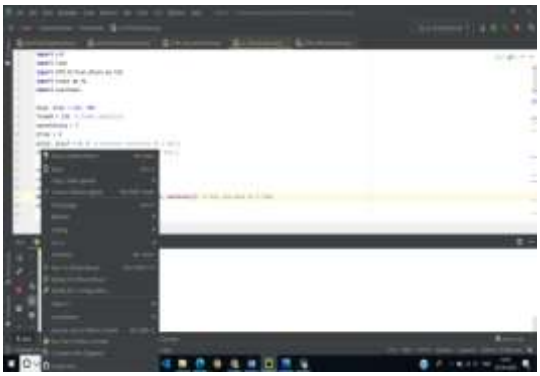


Fig.11. More options using right click

For both left click and right click if the distance between both the fingertips is less than 40 then the system will execute a double click. As shown in fig. 8 and fig. 9 the middle point will turn green at the execution of a double click.

Fig 10 shows text selected by using the left click hand gestures and Fig 11 shows right-click after execution of the virtual mouse.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 968-972 www.ijaem.net ISSN: 2395-5252

Comparative Analysis:

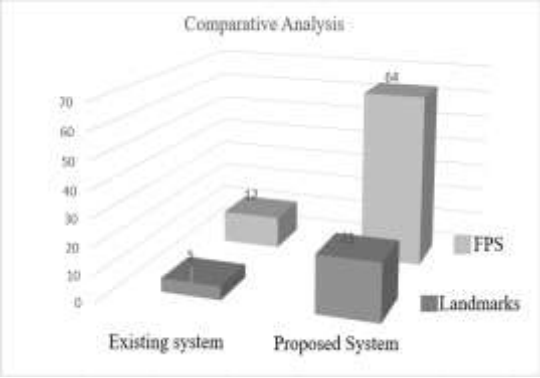


Fig.12. FPS and landmarks provisional analysis of existing and advanced system

Fig 12 shows a provisional analysis of existing and advanced systems. The authors have used two parameters, FPS and detected hand landmarks by the system. And also in the existing system, forefinger and middle finger are used for right-clicking, but often we use left-click the most. That's why in the proposed system, authors are using the forefinger(index finger) and middle finger for left-click.

A. FPS

The rate at which back to back or series of images called frames appear in a display is known as Frames Per Second (FPS).

A video or footage captured by a webcam can be called a series of images or bursts of images that are presented at a certain speed or ratio. As the value FPS increases, accuracy of the system increases.

B. Landmarks

The 3D localized key points detected in the captured hand images or video are known as Landmarks. In the existing system only the fingertips are detected, thus gesture movement is not captured properly. For more accuracy and efficiency results in the proposed system, the authors have developed 21 3D landmarks to detect complete hands.

Fig 3 and 4 shows detected hand landmarks by the system.

V. CONCLUSION

. Using a real-time camera we are designing a system that controls the mouse functionality of a computer system.

. We can perform mouse functions using AI virtual mouse such as right-click, left-click, scrolling, etc.

.The advantage of the system is as it reduces workspace.

.This system is used for presentation purposes also, where we are unable to connect the mouse like in buses, railways, and so on.

. This system detects the hand position which is used to process particular mouse functions.

REFERENCE

[1]. Google."MediaPipe" from github.com
[2]. Google. "OpenCV Python Tutorial " from geeksforgeeks.org
[3]. Google. "NumPy Tutorial" from w3schools.com
[4]. "Virtual mouse using hand gesture and color detection" October 2015: International Journal of Computer Applications
[5]. Rhitivij Parasher, Preksha Pareek "Event triggering using hand gesture using open CV" . (2016)
[6]. J. Katona, "A review of human–computer interaction and virtual reality research fields in cognitive InfoCommunications," Applied Sciences
[7]. Aynur Unal " Smart Trends in Information Technology and Computer Communications.
[8]. V. Bazarevsky and G. R. Fan Zhang. On-Device, MediaPipe for Real-Time Hand Tracking.
[9]. Litong Fan, Zhongli Wang, Baigen Cail, et.al (2016). A survey on multiple object tracking algorithm
[10]. Pyauto GUI https://pyautogui.readthedocs.io/en/latest/
[11]. Artificial Intelligence[google]:
[12]. https://en.wikipedia.org/wiki/Artificial_intelligence