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GESTURE-CONTROL-VIRTUAL-MOUSE

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ABSTRACT

Hand tracking and gesture tracking have recently become a staple, opening many opportunities and challenges. There is growing interest in computer vision, which is accompanied by rapid development and improvement of accessible hardware that can support new developments in AI. This article outlines and implements some of these possibilities and summarizes challenges and future prospects across the spectrum of human user interaction and virtual reality. The motivation behind this treatise is to reduce human interactions and reliance on devices to control computers, given the prevalence of COVID19. These results will help drive further research and support the use of virtual environments in the long run. The proposed era dont have any such boundaries and could alternatively depend on gesture recognition. In this mission, operations like clicking and dragging of objects may be achieved with different hand gestures. The proposed project will be requiring only a webcam as an input tool. The software program's that will be required to put into effect the proposed machine are opencv and python. The output of the digital camera may be displayed at the machine's display screenso that it may be in addition calibrated by means of the user. The python dependencies that will be used for implementing this machine are numpy, math, wx and mouse.

Keywords: Gesture Control Virtual Mouse, Virtual Mouse, Hand Gestures.

I. INTRODUCTION

With the present-day advances in VR (Virtual Reality) and its utility in each day lives, Bluetooth and wi-fi automation are getting more and more accessible. This paper proposes a visual AI machine that makes use of pc imaginative and prescient to carry out mouse, keyboard, and stylus capabilities the use of hand gestures and hand tip acquisition. Instead of the use of fashionable headsets or outside devices, the proposed system tracks finger and hand movements and uses a webcam or built-in camera to process the computer. It's simple and effective, so this solution can be removed continuously [1]. Use of additional hardware, battery life, and ultimately brings ease of use.AI mouse programs are developed using the Python programming language and the computer library OpenCV. The proposed AI visual mouse system model uses the Media Pipe package to track hands and titles, and the Pynput, Autopy, PyGames, and PyAutoGUI packages to navigate the computer screen, left-click, right-click. Perform tasks such as scrolling. The results of the proposed model show a very high level of accuracy, and the proposed model works very well in real applications even if it uses the CPU and not the GPU [2].

II. RELATED WORK

Several related works have been carried out on virtual mouse using glove-wearing hand gesture recognition, and using color tips in the hands to recognize gestures, but they aren't more accurate. Due to the wearing of gloves, the recognition may not be very accurate; further, the gloves may not be suitable for some users, and in some cases, failure to detect colour tips may result in the recognition not being very accurate. An attempt has been made to detect hand gestures using a camera. As early as 1990, Quam introduced a hardware-based system; in this system, the user wears a DataGlove [10]. Although the system developed by Quam yields results of higher accuracy; some gesture controls cannot be performed with the system. In 2010, Dung-Hua Liou, ChenChiung Hsieh, and David Lee presented a study on "A Real-Time Hand Gesture Recognition System Using Motion History Image [11]."Its main drawback is the difficulty of handling more complex hand gestures. In 2013, Monika B. Gandhi, Sneha U. Dudhane, and Ashwini M. Patil [12] proposed a study on "Hand Gesture Recognition for Cursor Control. "In this study, stored frames are needed to process skin pixel detection and hand segmentation. The IJCA Journal published a paper by Vinay Kr Pasi, Saurabh Singh, and Pooja Kumari [13] in 2016 entitled "Cursor Control using Hand Gestures. "Different bands are provided by the system to perform

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different mouse functions. However, it relies on the different colours to Accomplish these functions. "Virtual Mouse Using Hand Gesture", where the model is detected using a color-based approach, was proposed by Chaitanya C, Lisho Thomas, Naveen Wilson, and Abhilash SS in 2018 [14]. However, only a few mouse functions are performed. Hand tracking result was rendered. (Left) Relative depths of hand landmarks presented using different colors. The smaller and lighter the circle, the closer the landmark appears to the camera. (Right): Real-time tracking of multiple hands[21]. As part of the motion detection process, the optical flow algorithm was used to implement the virtual mouse. Following are the independent procedures that are implemented in the final implementation: A) User initialization, B) cursor movement, and C) click detection[22]. In order to implement the relative virtual mouse, the proposed technique detects relative movements of a user's head within an image and converts them into relative movements of the mouse. This algorithm uses a hand gesture recognition system along with inputs from a webcam to identify motion in images. This can easily replace the traditional mouse system that has been in use for decades[23]. Based on the detected human hand, the proposed system moves the pointer in the direction of the hand to control the mouse pointer. Controlling simple mouse functions such as left-clicking, Using a real-time digital camera, cursor motion can be managed, instead of pressing buttons manually or converting mouse positions on a physical computer [24]

Challenges:

Hand Detection: For ease of operation, it is important to encourage the discovery and following of hands and separate themselves from the unmistakable universe. But managing fabric things can interfere with our capacity to see and distinguish [3]. Due to contrasts in organic appearance and non-biological kinematics and/or variables such as temperature and surface may cause an issue.

Hand Tracking: Tracking the hands is reliable at close range, perhaps for purposes of increasing the visibility of individual viewing cameras. As the scope of virtual reality broadens so that hands can be part of everyday activities, hand tracking will become more reliable as well. Due to the low visibility in this space region,tracking and visualization may become even more difficult [4]

Involvement and Inclusivity: Hand-tracking and demonstrations present a diverse set of challenges related to irregular Embodiment and inclusion. Separating the skin from the surrounding area is a key aspect of hand tracking because it allows the user to form, and then visualize, the strength of the hand. Another potential problem not explicitly addressed is skin color[5].

GESTURE RECOGNITION BASED ON COMPUTER VISION:

Touch-based touch perception is currently the most widely used diagnostic method. Touch image information is collected from one or more cameras, and the collected data is pre-processed, such as sound removal and information enhancement [11]. It then uses a separation algorithm to detect the target touch in the image. The separation of actual touch and meaning can be obtained by processing and analysing the video, and finally, the target touch is identified by the touch detection algorithm.Touch-based touch recognition consists of three main parts: touch recognition, touch analysis, and touch detection. The first step is to tap the input image to create a segment.

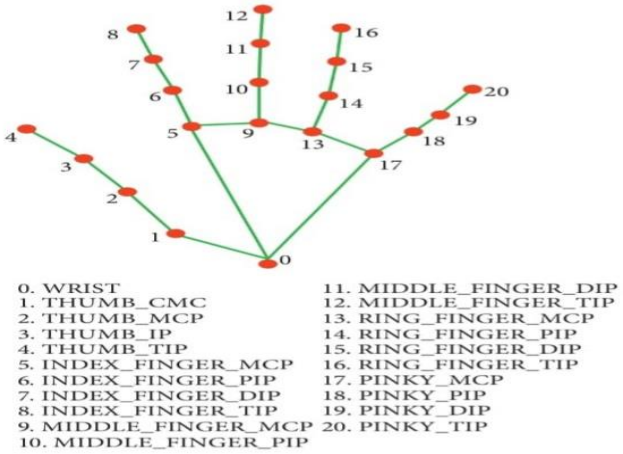

Figure 1

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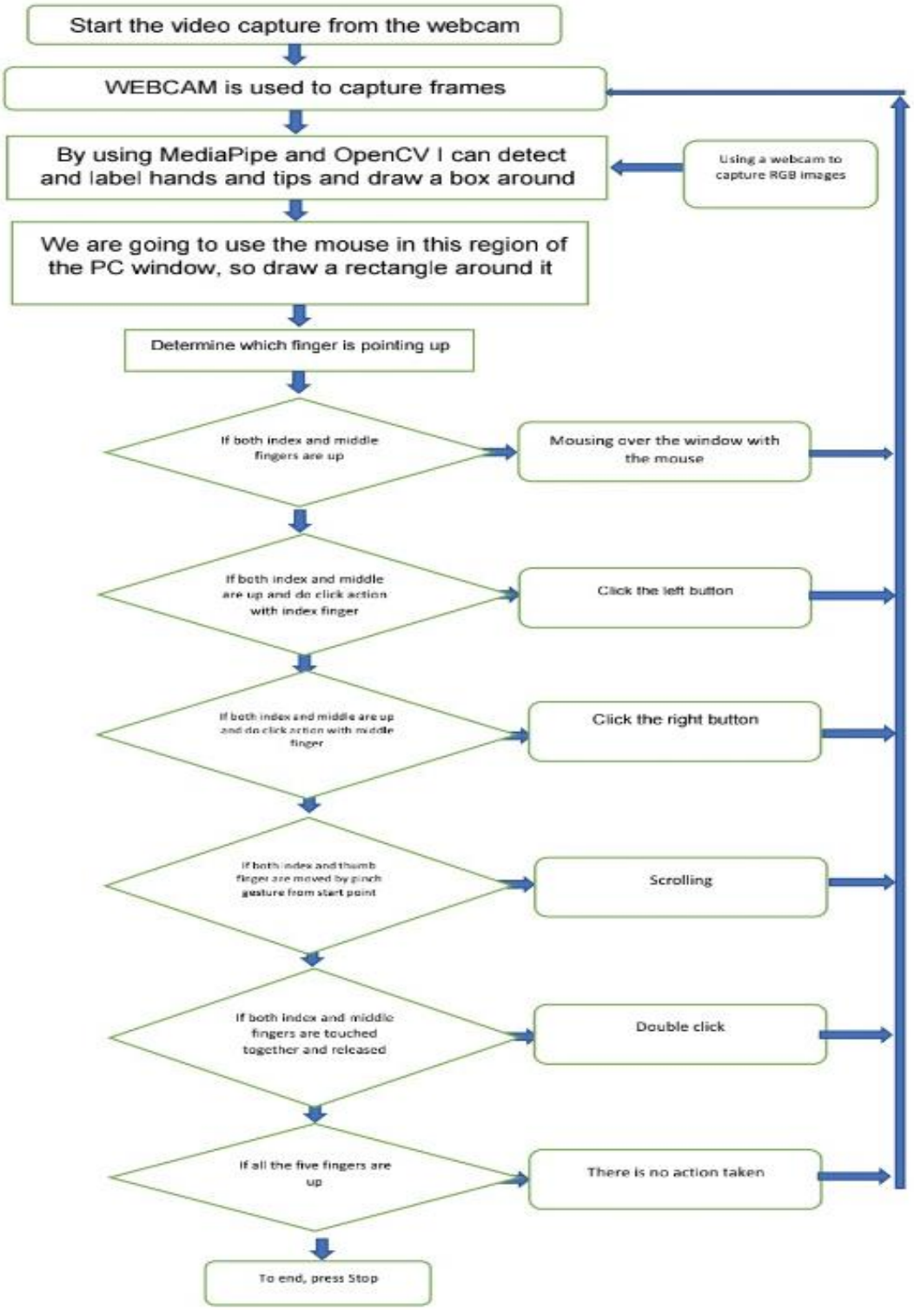
The touch separation process consists of two main parts: touch and touch separation. The touch area process removes the touch circuit from the background complex with self-tracking of the image containing the touch and applies touch separation from the background. The touch phase segment uses a post-touch algorithm to separate [12] the current touch from the background. Currently, touch modelling technologies mainly include visual-based touch modelling and 3D model-based touch models. Appearance-based touch models can be divided into vertical 2D models and moving models. Second, touches are organized and analysed.

Algorithm used:

The various functions and conditions used in the system are explained in the flowchart



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Cameras used in AI visual systems: The proposed gesture mouse system is based on images captured by a webcam on a portable computer or PC. As shown in Figure 2, a VCR is created using the OpenCV Python computer library and the webcam starts recording video. The webcam captures the frame and sends it to the visual AI system [13]

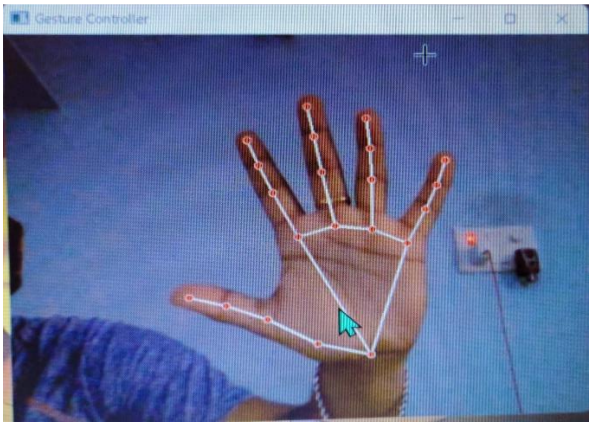

Figure 2: No response

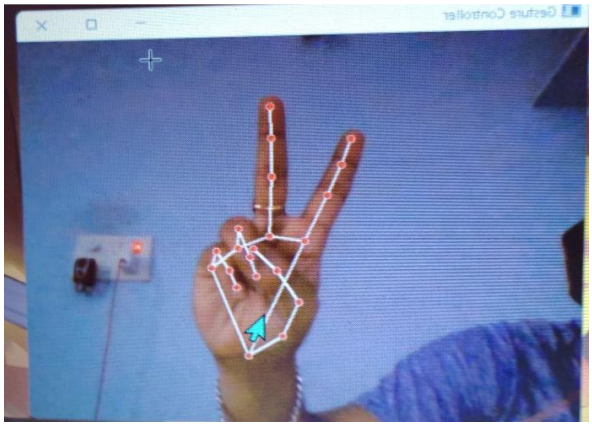

Figure 3: To move cursor

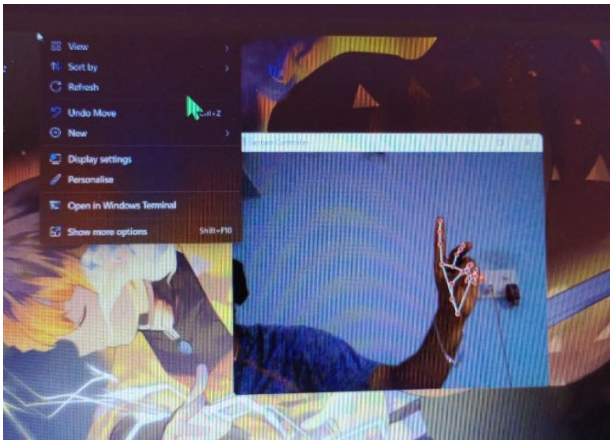

Figure 4: To perform right click

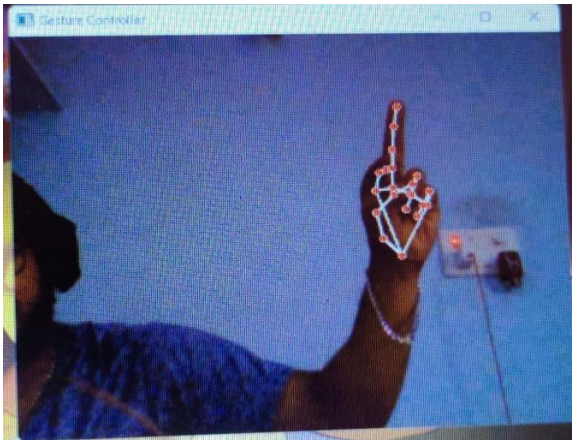

Figure 5: To perform left click

Video Recording and Processing: The Visual AI Mouse System uses a webcam that scans each frame until the program completes. The video image is processed from the BGR into RGB colour space, and the video is taken frame by frame, as shown in the following **code.**

def findHands (self, img, draw = True):

imgRGB = cv2.cvtColor (img, cv2.COLOR_BGR2RGB)

self. results = self. hands. Process (imgRGB) [14]

Virtual screen matching: The gesture control mouse system uses a conversion algorithm to convert the finger link from the webcam screen to the full screen mode of the computer window to control the mouse.[15] When you find your hand and decide which finger to raise to perform a particular mouse function, a rectangular box is drawn towards the computer window In the webcam area, and you hover your mouse pointer over the window. It is shown in the figure below. Recognizing which finger is up and performing the appropriate mouse function: In this section, we use the same fingerprint ID that you detected using Media Pipe and the corresponding finger link shown in Figure to see which finger is on top and specific mouse functions accordingly to execute.[16]

III. EXPERIMENTAL RESULTS AND EVALUATION

An AI system utilizing computer vision to improve human-computer interaction is proposed in the proposed visual mouse AI system. Because of the limited number of data sets available, it is difficult to compare contradictory outcomes of testing of visual AI mouse systems. A total of 600 hand-labeled touches were obtained through this test, which was performed 25 times by four people in different lighting conditions and at

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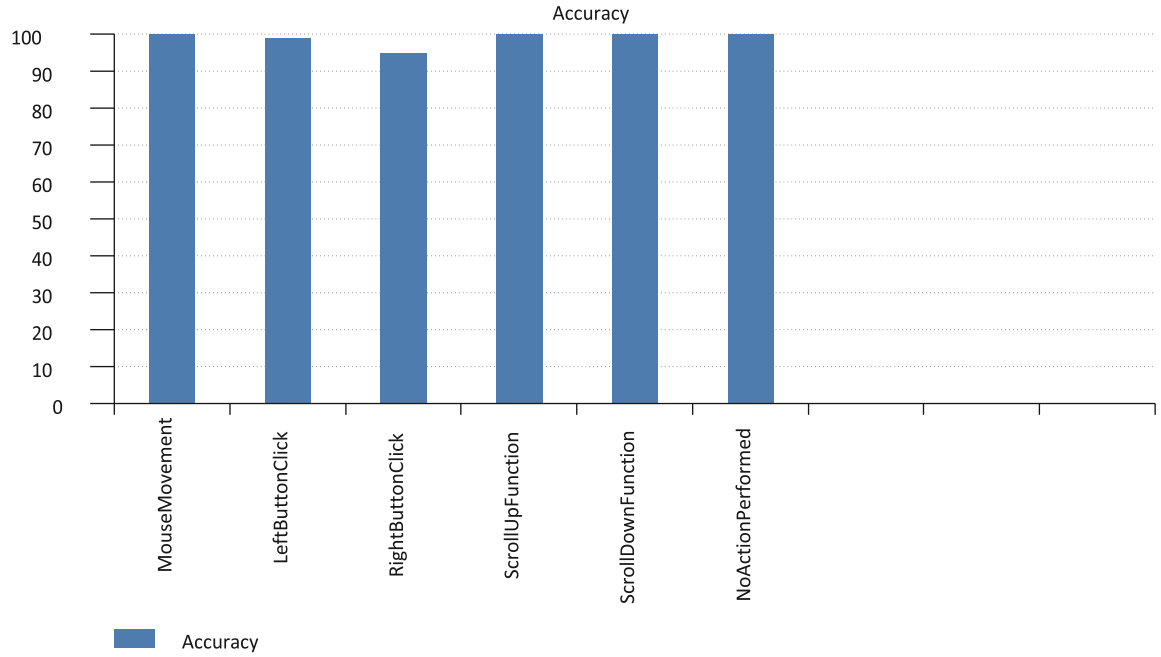
different distances from the screen, and each person tested the visual mouse system individually. In Table 1, the results of 10 AI tests performed in normal light conditions, 5 AI tests performed in dim light, 5 AI tests performed near the webcam, and 5 AI tests performed at a distance from the webcam are tabulated.

Table 1: Experimental results.

Mouse function		Accuracy		
Hand tip gesture * performed		Success (%)	Failure	
Tip ID 1 or both tip IDs 1 and 2 are up	Mouse movement	100	0	1(
Tip IDs 0 and 1 are up and the distance between the fingers is <30	**Left button click**	99	1	9
Tip IDs 1 and 2 are up and the distance between the fingers is <40	**Right button click**	95	5	9
Tip IDs 1 and 2 are up and the distance between the fingers is >40 and both fingers are moved up the page	Scroll up function	100	0	1(
Tip IDs 1 and 2 are up and the distancebetween the fingers is >40 and both fingers 100 are moved down the page	Scroll down function		100	0
All five tip IDs 0, 1, 2, 3, and 4 are up	No action performed	100	0	1
Result		594	6	9

* Finger tip ID for respective fingers: tip Id 0: thumb finger; tip Id 1: index finger; tip Id 2: middle finger; tip Id 3: ring finger; tip Id 4: little finger.

A visual AI mouse system can be seen to have achieved approximately 99% accuracy in Table 1. We know that this proposed visual AI mouse system works well because it has 99% accuracy. This is because the most difficult task for a computer to handle is "Right-click," as can be seen in Table 1. It is very difficult for a computer to detect a right-click. Moreover, the accuracy on all touches is outstanding and is very good with regard to a particular mouse function.[18] Furthermore, the touch used to perform the function is very difficult. With 99% accuracy, our visual mouse model outperforms previous methods of visual detection. In Figure 5, you can see an example of its performance.



IV. CONCLUSION

The main goal of the AI visual mouse system is to allow the user to control the mouse pointer function with a hand touch instead of manipulating things. Hand gestures and hand tips are captured and processed by the proposed system. You can access these systems through a webcam or built-in camera. The proposed model is so

accurate that it can also be used in real-world applications. For example, it can be used to reduce the spread of COVID19 and eliminate the need for wearable devices. Some drawbacks of the model include a slight decrease in the accuracy of the right-click feature and the difficulty of clicking and dragging to select text. As a result, we will try to address these limitations in the future by developing fingerprint capture methods that provide more accurate results.

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