A Comprehensive Review of Virtual Mouse Control Using Hand Gestures

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Abstract—This document suggests a manual method of moving the cursor position without requiring for an electronic device. On the other hand, various hand motions will be used to do tasks like clicking and dragging objects. A webcam is all that will be needed as an input device for the proposed system. The PC's camera will perceive different hand motions and utilize that data to move the mouse, or cursor, in light of the developments. It will even utilize distinct gestures to click the left and right buttons. The These models hold the key to significantly increasing the usability of such computer vision solutions by simulating the swaying motion of human hand motions. Numerous technologies are continually changing in the technological landscape of today. The idea is to imitate mouse functionalities on a screen without the requirement for any equipment by utilizing hand and finger signals, an interaction known as motion acknowledgment. This essay aims to reduce human-computer connection and dependence on technology in light of the COVID-19 pandemic. These results will eventually motivate further research and boost the use of virtual environments. These limitations are absent from the proposed period, which might instead rely on gesture recognition.

Keywords—Gesture Control Virtual Mouse, Virtual Mouse, Hand Gestures, OpenCV

I. INTRODUCTION

Nowadays, the majority of our work is done on computers, and people's daily interactions with them are becoming more seamless. These hand gestures provide effective means of expressing words, feelings, and ideas. In nonverbal communication, gestures are used to convey specific messages. One can convey this information by using their hands, face, or body. Technological developments in artificial intelligence and computer vision have enabled computers to record and identify hand motions performed by humans, hence promoting human machine interaction. As technology develops, devices become smaller. While some gadgets are still invisible, others are already wireless. As we chart a course towards an ever more interconnected future, it is innovations like these that serve as beacons of possibility, illuminating the path towards a more efficient and enriching computing experience. We now primarily rely on computers for our work, as the daily interactions between individuals and computers continue to become more seamless and efficient. Specifically, hand gestures have emerged as effective tools for conveying thoughts, emotions, and language in a nonverbal manner. These gestures play a key role in communication by conveying specific messages through the use of hands, facial expressions, and bodily movements. Because of progressions in man-made reasoning and PC vision advancements, PCs are presently prepared to do precisely catching and deciphering human hand motions, accordingly upgrading the general human-machine communication experience. This comprehensive system enables users to seamlessly manipulate their computers through intuitive hand gestures, culminating in a more immersive and efficient computing experience[3].

II. PROPOSED SYSTEM

In order to control a virtual mouse, this research suggests a real-time hand gesture recognition system. A webcam will be used by the system to record video input of the user's hand. The video frames will be processed using machine learning algorithms, which will enable fingertip tracking and hand detection. Certain mouse functions, such moving the cursor, clicking, and scrolling, will be mapped to specific hand motions. The user's hand movements will be continuously analysed by the system, which will then convert them into real-time mouse movements on the computer screen[9].

III. METHODOLOGY

A utilitarian block chart of the recommended framework is displayed in figure 1, showing how the framework capabilities. We need to lift our hand towards the webcam. The video is initiated and the frames are captured by the webcam. Pre-processing was applied to the supplied image. Standardizing the image is the major purpose of the image preprimary processor. Normalization is the most common way of resizing and pre-handling a picture to make its levels and widths equivalent [2].

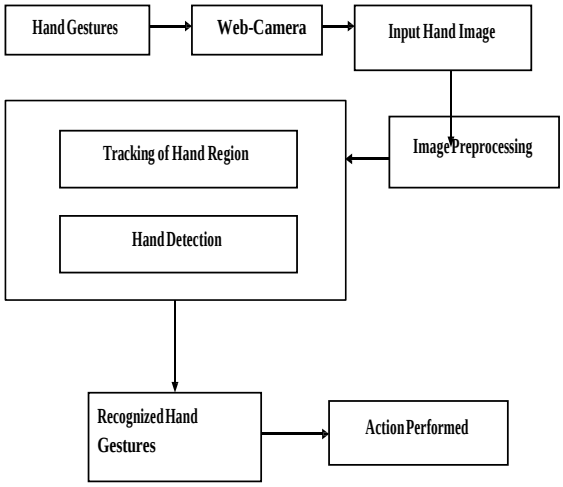

Fig- 1. Architecture diagram

The typical image is now processed utilizing an image processing approach in order to enhance its quality. After image processing, the camera moves its hand, and MediaPipe and OpenCV are used to detect the finger tips. It starts to sketch after identifying the hand and fingertip positions. On the screen, there are hand landmarks and a box that surrounds the hand. Draw a rectangular box on the window PC to accommodate the mouse. It will identify the fingers that are up and down on you. The mouse action is carried out based on the finger detections, and then the program goes back to the frames to carry out the subsequent action. This is how the system functions as a whole.

IV. ALGORITHM

Step 1: Start

Step 2: Initiate the webcam video capture and initialize the system.

Step 3: Capture frames using a webcam.

Step 4: With the help of MediaPipe and OpenCV, spot hands and fingertips, and then draw landmarks on the hands while outlining them with a box.

Step 5: Create a rectangle around the computer window region where the mouse will be utilized.

Step 6: Determine and recognize which specific finger is raised in the given context.

Step 6.1: Identify and distinguish the particular raised finger within the given context.

Step 6.2: The cursor advances to step 2 when both the middle and index fingers are raised.

Step 6.3: A double-click is executed when both the index and middle fingers are aligned side by side, triggering step 2.

Step 6.4: Initiate a left-click and progress to step 2 when both the index and middle fingers are lowered.

Step 6.5: Perform a right-click and move on to step 2 when the middle finger is lowered and the index finger is raised.

Step 6.6: Adjusting the volume up and down is achieved by bringing together the thumb and index fingers and moving them in an upward or downward motion.

Step 7: To conclude, press the EXIT key.

V. FUTURE SCOPE

Virtual mouse control and hand gestures hold great potential for the future. Future advances in gesture detection should make it easier for users to engage in more complex interactions by allowing them to zoom, scroll, and make multi-finger movements with ease. Voice command integration will enhance this natural interface even more, offering a really intuitive way to communicate with computers. Beyond individual requests, multimodal interaction will allow users to effortlessly merge hand gestures with touch screens or keyboards, enabling collaborative workspaces that increase efficiency. Updating accessibility features and creating an inclusive computer environment are two benefits of adaptive interfaces for individuals with disabilities. Natural engagement in virtual and augmented reality environments is made possible by 3D hand tracking, which goes beyond traditional computers. To operate smart home appliances, think of using a simple hand gesture or engaging with objects in a virtual world. Zeroing in on constant execution to guarantee smooth cursor development, UI plan that gives clear direction on upheld signals, and strong security and protection measures to safeguard client information can assist you with making a particular and powerful virtual mouse framework that shapes the fate of human-PC communication.

VI. APPLICATIONS

With hand gestures, virtual mouse control goes beyond the conventional desktop environment and opens up a world of fascinating possibilities. By offering cursor control through head tracking or eye gaze, it fosters greater freedom and empowers persons with disabilities. Imagine, for creative professionals, being able to browse through photographs with a wave of your hand or manipulating things in 3D design software with intuitive hand gestures. Regular hand association rejuvenates virtual and increased reality encounters, empowering clients to interface with expanded things and explore virtual conditions easily. Gesture-controlled activities have the potential to revolutionise the gaming industry by enhancing gameplay with a strategic and engaging element. Smart offices and residences can also profit. Consider utilising basic hand gestures to operate media players, thermostats, and lights It is not difficult to explore

and team up with introductions Hand signals can be utilized to control whiteboards, establishing a more participatory workplace. Your hand gesture-based virtual mouse project has the potential to revolutionise human-computer interaction in a number of sectors by investigating these many applications.

VII. ADVANTAGES

Virtual mouse control with hand gestures has numerous advantages over traditional methods. Firstly, it promotes accessibility by providing an additional input method for those with limited hand movement. Imagine being able to operate the cursor just by looking at the desired location or by using head tracking, which would foster greater independence, for those who struggle with traditional mouse control. Second, interacting with computers with hand gestures is a more logical and organic way to use technology. Imagine being able to look through photos with ease with just a flick of your fingertips or control objects in 3D design software with a simple wave of your hand. This straightforward interaction can enhance productivity and creativity for designers and artists. Thirdly, hand motions in expanded and computer generated reality can set out new open doors. Think of interacting with augmented reality or going virtual. Using simple hand gestures to manipulate objects creates a very immersive and fascinating experience. All things considered, hand gesture-based virtual mouse control enhances user experience, increases accessibility to computers, and opens up possibilities for innovative collaboration across several industries.

VIII. CONCLUSION

The primary goal of the artificial intelligence virtual cursor system is to eliminate the need for a physical mouse by controlling mouse cursor functions with hand movements. A webcam or an incorporated camera that perceives hand signals and tips and cycles these casings to do the necessary mouse developments can be utilized to execute the proposed strategy. In synopsis, the proposed man-made brainpower virtual mouse framework beat past models regarding precision and execution, and it basically settle those issues. Useful applications can make benefit of the falsely wise virtual cursor since the recommended model is more exact and can be worked electronically with hand signals instead of an ordinary equipment mouse.

IX. REFERENCES

[1]. Chen-Chiung Hsieh and Dung-Hua Liou, “A Real Time Hand Gesture Recognition System Using Motion History Image “, ICSPS, 2010.

[2]. G N Srinivas, S Sanjay Pratap, V S Subrahmanyam , K G Nagapriya, A Venkata Srinivasa Rao, “Virtual Mouse Control Using Hand Gesture Recognition“, IRJET ,Feb 2023, e-ISSN: 2395-0056 p-ISSN: 2395-0072.

[3]. Bharath Kumar Reddy Sandra, Katakam Harsha Vardhan, Ch. Uday, V Sai Surya, Bala Raju, Dr. Vipin Kumar, “GESTURE-CONTROL-VIRTUAL-MOUSE”, IRJETS, April-2022, e-ISSN: 2582-5208.

[4]. Kavitha R, Janasruthi S U , Lokitha S , Tharani G.” HAND GESTURE CONTROLLED VIRTUAL MOUSE USING ARTIFICAL INTELLIGENCE”.

[5]. Abhik Banerjee , Abhirup Ghosh , Koustuvmoni Bharadwaj , Hemanta Saikia, “Mouse Control using a Web Camera based on Colour Detection”, Mar 2014, IJCTT.

[6]. Nagaraj M. Lutimath, Niharika K, K Bhuvanesh, Mohan M and Muhammad Zidan K M,” The Design of Hand Gesture Controlled Virtual Mouse Using Convolutional Neural Network Technique”, May 2023, IJIRT, ISSN: 2349-6002.

[7]. Piyush Pilare, Coral Mahato, Chanchal Khergade, Shubham Agrawal, Prasheel Thakre,” IMPLEMENTATION OF HAND GESTURECONTROLLED MOUSE USING ARTIFICIAL INTELLIGENCE “, August - December 2022, ISSN: 2254-4143.

[8]. Ajay Sarwade, Gautami Sirsul, Shruti Salaskar, Vrushali Chennur, ” GESTURE RECOGNITION BASED VIRTUAL MOUSE AND KEYBOARD”, IJCRT, 2023, ISSN: 2320-2882.

[9]. Vijay Kumar Sharma, Vimal Kumar, Md. Iqbal, Sachin Tawara and Vishal Jayaswal “Virtual Mouse Control Using Hand Class Gesture” , · December 2020, ISSN NO : 1869-9391.

[10]. Hojoon Park, “A Method for Controlling the Mouse Movement using a Real Time Camera”, Brown University, Providence, RI, USA, Department of computer science, 2008.

[11]. Anadi Mishra, Sultan Faiji , Pragati Verma, Shyam Dwivedi, Rita Pal, “Virtual Mouse Using Hand Gesture”.