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VIRTUAL MOUSE WITH GESTURE CONTROL

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ABSTRACT

Many technologies are changing daily in today's technological age. Human-system interface is one such exciting idea. For instance, there is no option to tighten restrictions in a stressed-out mouse. Wi-Fi mice require Bluetooth hardware to be installed on the laptop and a Bluetooth dongle to be connected. In this paper, the usage of various gestures of hand is shown to depict activities such as dragging out of things, clicking and others. Only a webcam will be required for the suggested device's input. OpenCV and Python are the two software programs that will be needed to implement the suggested machine. The turnout from the digital camera can be seen on any machine's screen so that the user can calibrate it in addition. In this paper, we offer up a refreshing way for HCI or Human Computer Interaction which allows the apparent motion of the cursor to be managed by a live camera.

KEYWORDS: *Human-Computer Interaction, Motion detection, Hand Gesture, Gesture Control, OpenCV, Mediapipe.*

1. INTRODUCTION

For a very long time, the computer vision community has been particularly interested in the subject of gesture recognition. Hand gestures represent a way of visual communication which can be conveyed with the help of palm centre, positioning of the fingers, and overall anatomy of hand. Hand gestures can be divided into two categories- static categories and dynamic categories. As the name suggests, static gesture is related to the steady anatomy of hand, while dynamic gesture is known for consisting of a variety of hand movements such as waving [1].

There are many discrete hand gestures that can be used for instance, handshake differs from individual to individual and also alters depending upon the location and occasion. The elementary distinction amongst the gesture and posture is that one emphasizes the form of the hand while the other emphasizes hand movement. Over the last ten years, computer technology has advanced significantly and integrated itself in daily life. The mouse is the main tool used in HCI or human computer interaction. In many existing real-world scenarios, such as Human Robot Interaction or HRI, the usage of mouse is not so appropriate for human computer interaction. Numerous studies already exist on the alternatives to the computer mouse for HCI.

The usage of the hand gestures is the most integrated and intuitive HCI interaction technique which can efficaciously replace a mouse of computer. Our main aim is to provide an alternate of the use of touch screen by creating a virtual mouse system which uses an internet camera for communication with other device in a more flowing manner. A webcam's full potential can be realized by using it for

vision-based computer vision (CC), which accurately tracks hand gestures and predicts gestures based on labels.

Our primary goal is to build-up a virtual mouse system which can make use of an internet camera for communicating with any device in a friendlier manner rather than a touch screen. For instance, we can use a webcam entirely for vision based applications that can help to track accurately the hand gestures and forecast gestures based on labelling, in order to fully utilize its capabilities.

2. LITERATURE REVIEW

A very authentic method for gesture detection, Motion detection algorithm and motion recognition algorithm, was applied in the publication Vision based Gesture recognition for HCI or Human Computer Interaction in June 2010. In this paper, Devanshu Singh described a cutting-edge technique which described the control of mouse motion using openCV on a real-time camera in the International Journal for Research in Applied Science and Engineering Technology [2].

In addition to this, openCV and Media pipe's official documentation was frequently cited utilizing hand and head gestures, a research paper titled "Vision-based Multi model Human Computer Interaction using Hand and Head Gestures" was released in 2013. Any applications that use an algorithm based on computer vision. Using head motion and hand patterns, it recognized gestures.

In a work titled "Vision based computer mouse control using hand gesture" published in 2015, a camera-based methodology was outlined that enabled lift clicks and right clicks as well as employed real-time video capture. Creating and filtering binary images were most widely used.

The paper "OpenCV for computer Applications which use vision" by Naveen Kumar Mahamakli was published in 2015 [3] on website "researchGate.net". The purpose of this paper and research was to describe how openCV processed images, the processes it took, and its various features.

3. PROBLEM DEFINITION

The two most known ways used for the hand gesture recognition are vision-enabled that takes input from the camera by applying image processing techniques and also is hardware-based. It requires that the user should wear a device to implement the algorithm. The suggested system is vision-enabled and makes use of camera inputs and image processing algorithms tracking and identification of gestures based on vision. Hand motions would be utilized to control the mouse, while the tracking of hand and its motion will be used to detect the movement of the cursor on computer.

4. INDUSTRY BENEFITTED

There are generally two ways to recognize the hand gestures: one of which is hardware based method that requires the necessity of wearing a tool by the user; and the other method is vision enabled that uses image processing techniques with capturing inputs from the camera. The suggested system is vision-enabled which makes the use of camera inputs and image processing algorithms. Identification and tracking of gestures is also done based on vision. Hand movements will be used for operating the mouse, and hand tracking gestures will help to make a motion on the computer's pointer [4]. The primary goal of this paper is be to create a vision- enabled system that will help to carry out the most aforesaid mouse function.

5. PROPOSED METHODOLOGY

This paper recommends a way for HCI or human computer interaction in which the cursor movements may be commanded using a real-time digital camera. This method is an improvement over the current approaches, which include manual button input or repositioning a physical computer mouse. Instead of that the method makes use of a camera and varying computer vision technologies to control various mouse functions and is also adequate to perform tasks which can also be performed by using a physical computer mouse.

Firstly the Mediapipe technique is used for identification of the hand and all the important factors of the hand. Mediapipe generates total 21 critical points for each and every recognized hand as shown in Figure 1. Mediapipe uses the hand landmark version and the palm detection [5].

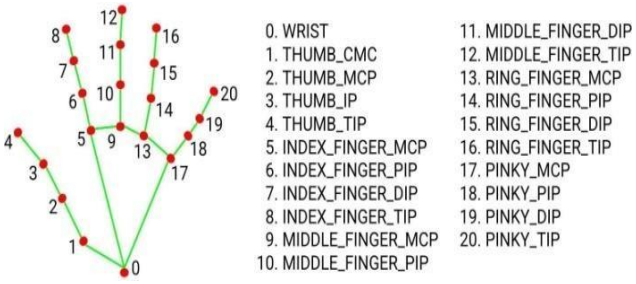

Figure 1. Co-ordinates or landmark in hand

6. WORKFLOW

6.1 Camera

The built-in camera on a laptop's screen or the web camera on a desktop computer is the frames that the system uses to operate. The setup will record webcam video in real-time scenario by building a video capture object. The device identification for such system would be a value of "0" for the purpose of using a single camera. Further additional camera device indices will soon be added namely, 1, 2, and 3. The system will get frame-by-frame data from this camera.

6.2 Capturing

The study and examination of images made from tissue samples or specimens is known as pathology and is a subfield of medical imaging. Microscopes are used by pathologists to analyze tissue samples. Pathologists are crucial in the diagnosis of sickness, finding anomalies, and determining the course of treatment. While physical sample examination is still necessary, deep learning and AI systems have opened up new possibilities. Medical imaging and pathology have a close relationship.

6.3 Color Detection and Masking

In the recommended system, the detection of colors is performed out with the help of identification of pixels of colors on the fingertips of user by using coloring caps from webcam frames. This is the initial and crucial step of the suggested device. The result of this stage can be a grayscale image, where the coloring cap location might be demonstrated and also the pixels' intensity varied from the rest of the frame. The coloring cap and rectangle boundary cap could then be monitored. The monitoring of the aforementioned color caps is necessary for the detection of the gesture.

6.4 Gesture Recognition

6.4.1 Mouse Movements: Firstly, all the coordinates of the center of the detected rectangle are utilized for calculating the centers of the two color objects that have been detected. The built-in OpenCV algorithm is used for drawing a line between the two given coordinates. For this purpose, the following equation is used to find the midpoint:

$$M= ((Xa+Xb)/2, (Ya+Yb)/2)$$

The mouse pointer uses this midpoint as a tracker, and it will follow this midpoint. The coordinates representing the resolution of the camera clicked frames are then after translated to the screen resolution of the system.

When the pointer of the mouse reaches a predetermined spot on the screen, the mouse automatically begins to function. This is known as an "open gesture." The user may now control the mouse movement thanks to this open gesture.

6.4.2 Mouse Clicking: For clicking events, the suggested system makes use of close motions. The edge of the tracking bounding boxes is used to build a bounding box whenever one rectangle's bounding boxes approach those of another rectangle. The system executes a left button click when the recently constructed bounding box reaches 20% of its size at the moment of construction. The user can make a double click while maintaining this posture for more than 5 seconds. Additionally, the open gesture is applied for the second right button click. One finger is sufficient to click the appropriate button. The system will recognize the hue of one fingertip, after which it will click the right button.

6.3.3 Mouse Scrolling: With this approach, the user must scroll by making an open gesture with three colored finger caps. Users can scroll down by putting three fingers together and moving one of them to the downward position.

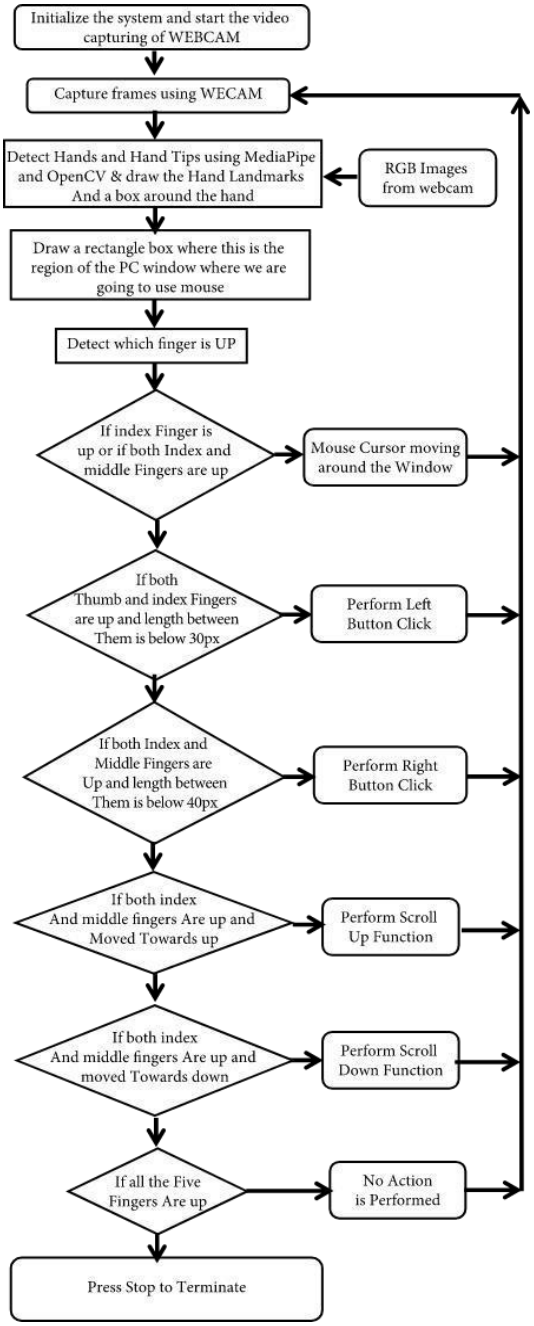

Figure 2. Flowchart depicting the steps of performing gesture recognition

7. SIMULATED RESULTS AND DISCUSSIONS

In order to lead to future vision-enabled human-machine interaction, we have used computer visual sensation and Human Computer Interaction in our work. The objective of the proposed paper is to employ gestures to hand for all the controlling mouse functionalities. Right button clicks, left button clicks, Mouse movement, double clicks, down-scrolling and up-scrolling are the elementary actions that can be performed with this system.

Users of this system can select any color from a variety of hues. Users can choose any color from the defined color ranges that are in harmony with the backgrounds and lighting circumstances. This could change depending on the background. For instance, the system of rules will allow the user the option to choose a color from a variety of hues (Yellow, Green, Blue, Red and two others) when they first turn it on. The user must choose a color that contrasts with the background rather from one that blends in. The user must also select a color that will stand out against the existing background.

Figures 3-6 depicts the snapshots of the gestures of hand instead of using mouse or any other touch-based device. It includes click gesture, neutral hand gesture, and neutral click gesture and cursor movement of mouse. Using this system will eliminate the need of any physical device for giving instructions to the computer.

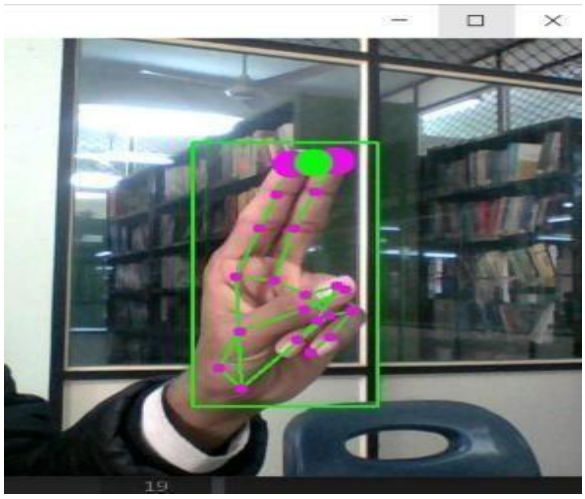

Figure 3. Screenshot of Click Gesture

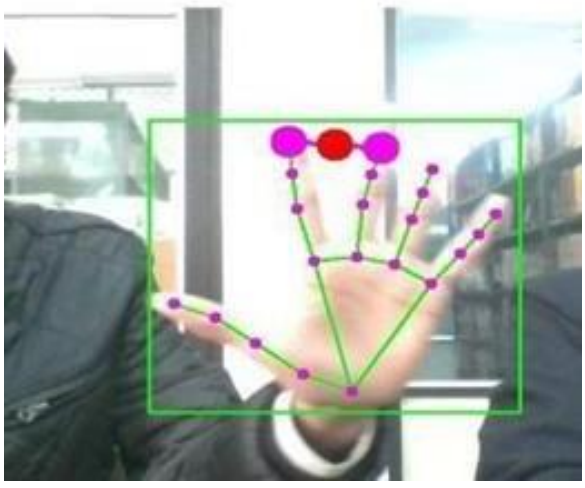

Figure 4. Screenshot of Neutral Hand Gesture

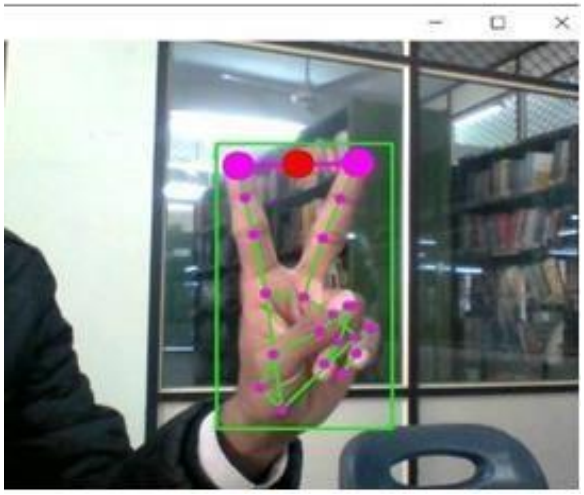

Figure 5. Screenshot of Neutral Click Gesture

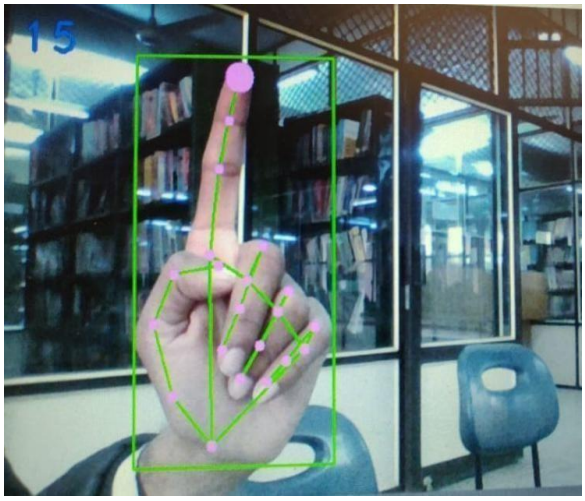

Figure 6. Screenshot of Mouse Cursor Movement

8. APPLICATIONS

This paper and its implementation are helpful for presentations as well as for minimizing area requirements and the weight of additional hardware. This technology will be able to endure itself in stressful situations like battlegrounds and operating rooms since it is more agile than any other modern computer interface system on the market. The user and the user's workspace are closer than previously since the load of the device is removed. Major applications are:

8.1 One of this system's primary uses is robot controlling. Controlling robots without the use of additional tools or gadgets is frequently a great advancement in technology.
8.2 Using this motion-based mouse, 2-D or 3-D images can be created by digital artists on digital canvases. It will help the artists by providing them more freedom, flexibility to a great extent, and more space for creating their art.
8.3 Gesture mice are commonly employed to control crucial events, which mimic battlefields, operating rooms, and areas for mining.
8.4 Computer games or games based on augmented reality can be played more easily with bare hands and no extendable or wireless gadgets.
8.5 This therapy frequently proves to be quite helpful and beneficial to individuals who are unable to exert control over their limbs.
8.6 This mouse approach is frequently appropriate for teaching sign language to the deaf and dumb.

9. CONCLUSION

Remote gesture control has a real-time camera that is employed by the mouse to control the mouse pointer and carry out its mission. We put icon selection, mouse piloting, and actions like left clicks, right clicks, double clicks, and scrolling into exercise [6].

In order to track icon selection and mouse indicator apparent motion, this method relies on picture comparing and apparent motion detection technology. During the analysis of the results, we frequently expected that the algorithms will function in whatsoever domain till we are providing a good quality camera and adequate lighting. Then, our systems will become more organized. In the time to come, we hope to aggregate more features like palm and multiple finger interaction with multiple windows, window enlargement and window reduction, window closing, etc. Using the palm and several fingers, open and close windows, enlarge and reduce windows, etc. Windows are enlarged and shrunk, surviving windows and many others by employing more than one arm and the palm just virtually without physically touching devices.

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