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Virtual Mouse using OpenCV and Mediapipe

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ABSTRACT: Gesture-controlled laptops and computers have recently gained a lot of traction. Leap motion is the name for this technique. Waving our hand in front of our computer/laptop allows us to manage certain of its functionalities. Over slides and overheads, computer-based presentations have significant advantages. Hand gestures are the most natural and effortless manner of communicating. The camera's output will be displayed on the monitor. The concept is to use a simple camera instead of a classic or standard mouse to control mouse cursor functions. The Virtual Mouse provides an infrastructure between the user and the system using only a camera. It allows users to interface with machines without the use of mechanical or physical devices, and even control mouse functionalities.

KEYWORDS: Gesture, Human Computer Interaction, Sensor, Co-ordinates.

I. INTRODUCTION

Within the past few years, as computer technology continues to expand, people want more compact electronic devices. Human Computing Interaction (HCI), especially gesture recognition and object recognition, are becoming rapidly important. In our project, we introduce a method for managing the mouse system using a video device (Mouse tasks). In today's world, most mobile phones communicate with the user via touch screen technology. However, this technology is still overpriced to use on desktops and laptop computers. The name "virtual mouse" conveys a clear idea about our project, the virtual mouse establishes a virtual connection between the user and the machine without the use of any hardware.

This gesture recognition system can capture and track the fingertips of a person wearing a colour cap with a webcam, and the system detects the hand's colour and movements and moves the cursor along with it. Our vision was to develop a virtual mouse system that uses a Web camera to communicate with the device in a more user-friendly way, as an alternative to using a touch screen.

II. RELATED WORK

As modern technology of human computer interactions become important in our everyday lives, varieties of mouse with all kind of shapes and sizes were invented, from a casual office mouse to a hard-core gaming mouse. However, there are some limitations to these hardware as they are not as environmental friendly as it seems. For example, the physical mouse requires a flat surface to operate, not to mention that it requires a certain area to fully utilize the functions offered. Furthermore, some of these hardware are completely useless when it comes to interact with the computers remotely due to the cable lengths limitations, rendering it inaccessible. During the trend in Human computer interaction new methods were discovered to make systems usable to users. The hand-mouse interface obtains high accuracy using a web-camera sensor; however, the gesture interplay is very convenient because the user can control the mouse using just two fingers. Moreover, the work is limited by the resolution of the virtual monitor.

The main objective of the proposed AI virtual mouse system is to develop an alternative to the regular and traditional mouse system to perform and control the mouse functions, and this can be achieved with the help of a web camera that captures the hand gestures and hand tip and then processes these frames to perform the particular mouse function such as left click, right click function.

III. METHODOLOGY

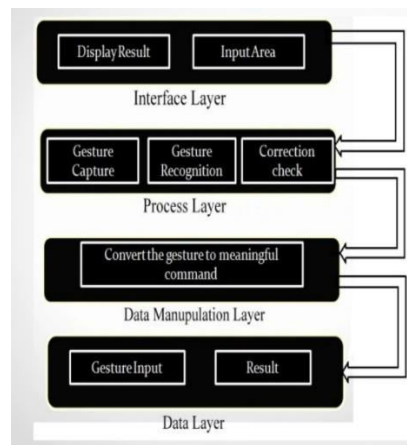
Using only a camera, the Virtual Mouse lays out an infrastructure between the user and the machine. It enables the user to interact with a machine without the requirement for any mechanical or physical devices, and even allows to control mouse functions.

There are many approaches to Human Computer Interaction. Few of them are being listed here:-

- In one outlook, given by Erdem et al, for direct the motion of the mouse uses fingertip tracking. The controls of mouse were implemented by specifying a screen such that a control of the mouse was initiated when a user's hand passed over the region.
- In another outlook, developed by Chu- Feng Lien, the idea uses the finger tips to control mouse operations. In this the mouse operations are based on image density, where the person is needed to hold the cursor at the desired spot for some period of time.
- In yet another outlook developed by Paul et al, the stirring of thumb is used to signify a clicking event. Hand gestures are used for mouse control. In his outlook, a colour pointer is used for object tracking and recognition. The left click of the mouse is performed by calculating the distance between the thumb and index finger while the right click event is performed by calculating the distance between thumb and middle finger.
- By referring Erdem and Paul methods, we are now designing a system that will recognize gestures through open computer vision. Hand gesture will be observed by the sensor which will be a webcam that will track the image of the gesture and then definite action according to the gesture will carried out.

IV. ARCHITECTURAL STRUCTURE

The architectural structure we designed for our project is shown below.



- The basic requirement of any system are its sensors. This system too has a sensor (webcam) is used to interact with the environment. Its functionality is to record the live video which is taken as input through hand gesture by the user.
- It processes this input and then sends it to OpenCV, here in CV a code is generated which is used to convert the live video into frames of images. This activity is technically termed as "slicing of video".
- And in this way output is produced and the mouse click is replaced by finger clicks, gesture recognition and image processing.
- It process a click when the distance between fingertips is less than a certain limit.

The AI virtual mouse system makes use of the transformational algorithm, and it converts the coordinates of fingertip from the webcam screen to the computer window full screen for controlling the mouse. When the hands are detected and when we find which finger is up for performing the specific mouse function, a rectangular box is drawn with respect to the computer window in the webcam region where we move throughout the window using the mouse cursor.

V. FUTURE SCOPE

In the end, it's no surprised that the physical mouse will be replaced by a virtual non-physical mouse in the Human-Computer Interactions (HCI), where every mouse movements can be executed with a swift of your fingers everywhere and anytime without any environmental restrictions. In this project we have developed a program with the motive of replacing the generic physical mouse without destroying the accuracy and efficiency, it is able to recognize finger tips movements, combinations of fingers, and translate the coordinates into actual mouse functions. Due to accuracy and efficiency plays a critical role in making the program as useful as an actual physical mouse, a few techniques had to be accomplish.



VI. CONCLUSION

Virtual Mouse is an idea of implementing an adaptable, multi- functional navigation/interaction tool that control physical barriers. Gesture recognition gives the best interaction between human and machine. It is also important for developing alternative human computer interaction modalities. It enables humans to interface with machines in more natural way. It can be used for many applications like sign language recognition for deaf and dumb people, robot control etc. This technology has wide applications in the fields of augmented reality, computer graphics, computer gaming, prosthetics, and biomedical instrumentation.

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