Computer Vision Algorithm Based Human Computer Interactive Virtual Mouse Using Finger Detection And WebCam

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ABSTRACT*:* Since the computer technology continues to grow up day by day, the importance of human and computer interaction (HCI) is speedily increasing. Nowadays almost all the mobile devices are come with touch-screen technology. However, this technology is not cheap enough to be used in PC. Creating a virtual human computer interaction device such as pointing device like mouse, input using a webcam and computer vision techniques can be the alternative way for the touch screen technology. In this cram, finger tracking based, a virtual mouse application has been designed and implemented using a regular webcam. The idea was to create an object tracking application to interact with the computer system, and develop a virtual human computer interaction device.

KEYWORDS: Computer vision, Human computer interaction, Image acquisition, Object recognition, Virtual mouse, Finger detection*.*

I. INTRODUCTION

Mouse is a physical device subject to mechanical wear and tear. In computing, a mouse serves as a pointing device that detects 2D motion relative to a surface. This motion is typically translated into the motion of a pointer on a display screen, which allows for fine control of a graphical user interface (GUI). In interactive 3D graphics, the mouse's motion often translates directly into changes in the virtual objects' or camera's orientation.

In our work, we have tried to control mouse cursor movement and click eventsusing a camera based on finger detection technique. Here, real time video hasbeen captured using a WebCamera. The user wears coloured tapes to provide information to the system. Individual frames of the video are separately processed. The processing techniques involve an image subtraction algorithm to detect colours. Once the colours are detected the system performs various operations to track the cursor and performs control actions.

The mouse actions involves left click, right click, double click, scroll-up, scroll-down. Here, a color pointer has been used for the object recognition and tracking. Left and the right click events of the mouse have been achieved by detecting the number of pointers on the image.

Since the system is based on image capture through a webcam, it is dependent on illumination to a certain extent. Furthermore the presence of other colored objects in the background might cause the system to give an erroneous response. Although by configuring the threshold values and other parameters of the system this problem can be reduced but still it is advised that the operating background be light and no bright colored objects be present.

II. IMAGE PROCESSING

An image processing is processing of images using mathematical operations by using any form of signal processing for which the i/p is an image, such as a photograph or video frame; the output of this method on image processing may be an image or parameters related to the image. Image processing usually indicates digital image processing, but optical and

analog image processing are also possible. Computer vision is closely related to image processing. Computer vision, is an image processing due to which a computer/machine/software aims to interpret the physical contents of an image or a sequence of images.

III. GESTURE RECOGNITION

Using mathematical algorithms human gestures can be recognized/interpreted using **gesture recognition**. From any bodily motion gestures can be originated but commonly originated from the face or hand. Gesture recognition allows humans to interact with the machine without any mechanical devices. For computers to begin to understand human body language, gesture recognition can be a way. In this study, the motivation is to recognize gestures originated from the hand such as 1.Single click, 2.Double click, 3.Right click, 4.Left click, 5.Drag and Drop, 6.Scroll-up and 7.Scroll-down, etc.

IV. VIRTUAL MOUSE

Virtual mouse can be used for mouse events like 1.Single Click, 2.Double Click, 3.Right Click, 4.Left Click, 5.Drag and Drop, 6.Scroll Up and 7.Scroll Down, etc. The application detects the hand movements given by user and performs operation accordingly. User can perform various tasks with his gestures. No extra hardware will be required except a webcam. Hence the system is less prone to any physical damage.

V. LITERATURE SURVEY

- Paper Name : The Computer vision based mouse.
  Author Name : Erdem Aykut, Yardimci, Atalay, Cetin.
  Description : The researchers have proposed a system which enables users to interact with the machine which works efficiently as that of the existing systems of computer vision. Computer vision techniques involves image processing.
- Paper Name: The Mouse Simulation Using Two Coloured Tapes.
  Author Name : Kamran Niyazi, Swapnil Mahe, Swapnil Vyawahare.
  Description : The researchers have simulated the mouse operations using two colour tapes. Using two tapes the mouse operations were performed like left click, right click, double click, scroll-up, scroll-down, etc. Two different color tapes are used to avoid the confusion.
- Paper Name: A survey on Human Computer Interaction Mechanism Using Finger Tracking.
  Author Name: K N. Shah, K R. Rathod and S. J. Agravat.
  Description: The researchers have proposed a system which enables users to interact with the machine using a finger tracking mechanism. The hand gestures are recognized by the system using the finger tracking mechanism. Finger tracking technique works very well. Hence the human computer interaction works good.
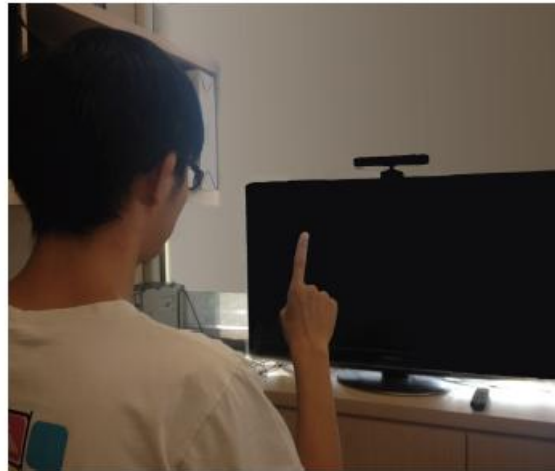
VI. PROPOSED SYSTEM

The method of operation is divided into following modules:
- ➢ Image Acquisition: It is simply defined as retrieving an image. It always serves as a first step in image processing because without an image, image processing cannot be done. For the image acquisition, user need to be seated as shown in the fig. 1. (a) which is the prototype of our system.

(a)
Fig.1. (a) The prototype of our proposed system

- Object Recognition: It is a way of action of identifying a specific object in a digital image. As shown in the   fig.1. (a), the camera will capture the video feed and the further processing will be done.
- Object Tracing & Information Retrieval method: It is simply the retrieval of information from the resource. In this case the resource is the digital image or video.
- Point coordinate Calculation and motion analysis: In this module, the coordinates of the hand movements is calculated and further results are generated. Here, the mouse pointer is traced using the coordinates obtained from the centroid of the region of the image. As shown in the fig.2. (a), the coordinates of the hand movements is calculated.
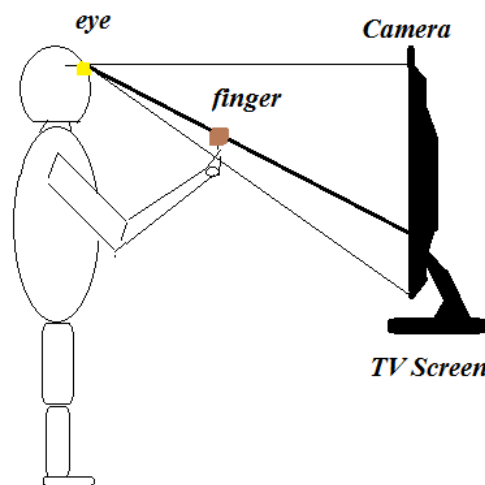
(a)
Fig.2. (a) The illustration of our Human Computer Interaction

> Event generation: This is the last step which simulates the mouse events by assigning the relative coordinates to the different colour stickers.

VII.   ADVANTAGES

i.   More comfortable.
ii. Provides greater flexibility than existing.
iii. Easy to modify and adopt.
iv. Less prone to physical damage due to absence of a fix physical device.
v.   Certain degree of fun, entertainment can be gained with the whole idea.

VIII.   LIMITATIONS

i.   Muscle pain will be caused by keeping the hand steady for so long.
ii. As many image manipulative operations are performed, the process is slow.
iii. The mouse coordinates will be affected by a small distortion in the center of hand in the image frame.

IX. FUTURE SCOPE

> Lot of research is going in the field of gesture recognition.
> For the future works, instead of colour stickers directly finger tips can be detected.

X. CONCLUSION

The system is to be implemented in OpenCV (Open Source Computer Vision) environment. As an object, three different colour stickers (Red, Blue, Green) are used to make the detection easy and fast. Object detection and motion tracking works very well. This system is based on the Computer Vision Algorithm and can do all mouse tasks.

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