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Mouse Controlling using a Web Cam based on Color Detection

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ABSTRACT*:* Many modules have been developed to help the physical world interact with the digital world. Here we present a novel approach for Human Computer Interaction (HCI) where, we control cursor movement using a real time camera and color pointers. Our method is to use a camera and computer vision technology, such as image segmentation, background subtraction and color tracking, to control mouse tasks (left clicking, right clicking, double clicking and scrolling actions) and we show how it can perform everything as current mouse devices can. A Color pointer has been used for the object recognition and tracking, so as to implement the module without any physical contact with the system. Click events of the mouse have been achieved by detecting the number of pointers on the images.

KEYWORDS: Human Computer Interaction, Background Subtraction, Color Detection, Web Camera, Computer Vision

I. INTRODUCTION

Human Computer Interaction today greatly emphasizes on developing more spontaneous and natural interfaces. The Graphical User Interface (GUI) on Personal Computers (PCs) is quiet developed, well defined and provides an efficient interface for a user to interact with the computer and access the various application Effortlessly with the help of mice, track pad, etc. In the present day scenario most of the mobile phones are using touch screen technology to interact with the user. But this technology is still not cheap to be used in desktops and laptops. Our objective was to create a virtual mouse system using Web camera tointeract with the computer in a more user friendly manner that can be an alternative approach for the touch screen.

II. RELATED WORK

"Many researchers in the human computer interaction and robotics fields have tried to control mouse movement using video devices. However, all of them used different Methods to make a clicking event. One approach, by Erdem et al, used fingertip tracking to control the motion of the mouse. A click of the mouse button was implemented by defining a screen such that a click occurred when a users hand passed over the region [1]. Another approach was developed by Chu-Feng Lien [2]. He used only the finger-tips to control the mouse cursor and click. His clicking method was based on image density, and required the user to hold the mouse cursor on the desired spot for a short period of time. Paul et al, used still another method to click. They used the motion of the thumb (from thumbs-up position to a fist) to mark a clicking event thumb. Movement of the hand while making a special hand sign moved the mouse pointer [3]." In this study, 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 pointer son the image

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IV. PROPOSED SYSTEM

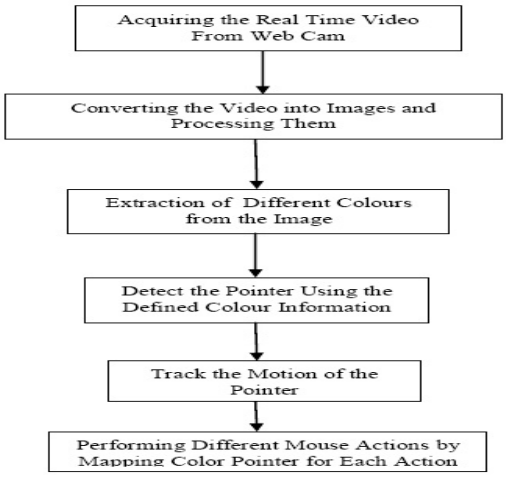
In our work, we have tried to control mouse cursor movement and click events using a camera based on colour detection technique. Here real time video has been captured using a Web- Camera. The user wears coloured tapes to provide
Information to the system. Individual frames of the video are separately 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 details of which are provided below. No additional hardware is required by the system other than the standard webcam which is provided in every laptop computer.

V. SYSTEM DESCRIPTION

Following are the steps in our approach:

- ✓ Capturing real time video using Web Camera.
- ✓ Processing the individual image frame.
- ✓ Flipping of each image frame.
- ✓ Conversion of each frame to a grey scale image.
- ✓ Colour detection and extraction of the different colours (RGB) from flipped gray scale image
- ✓ Conversion of the detected image into a binary image.
- ✓ Finding the region of the image and calculating its centroid.
- ✓ Tracking the mouse pointer using the coordinates obtained from the centroid.
- ✓ Simulating the left click and the right click events of the mouse by assigning different colour pointers.

Fig 1: Basic Flow of of Proposed System



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Capturing the Real Time Video: For the system to work we need a sensor to detect the hand movements of the user. The webcam of the computer is used as a sensor. The webcam captures the real time video at a fixed frame rate and

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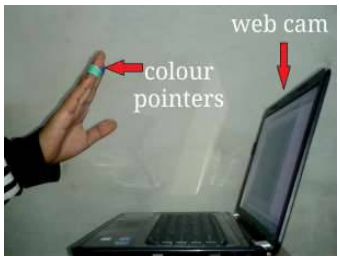
resolution which is determined by the hardware of the camera. The frame rate and resolution can be changed in the system if required.

- ✓ Computer Webcam is used to capture the Real Time Video
- ✓ Video is divided into Image frames based on the FPS (Frames per second) of the camera

Fig 2: Capturing the Video



Flipping of Images: When the camera captures an image, it is inverted. This means that if we move the color pointer towards the left, the image of the pointer moves towards the right and viceversa. It's similar to an image obtained when we stand in front of a mirror (Left is detected as right and right is detected as left). To avoid this problem we need to vertically flip the image. The image captured is an RGB image and flipping actions cannot be directly performed on it. So the individual color channels of the image are separated and then they are flipped individually. After flipping the red, blue and green colored channels individually, they are concatenated and a flipped RGB image is obtained.

Conversion of Flipped Image into Gray Scale Image: As compared to a colored image, computational complexity is reduced in a gray scale image. Thus the flipped image is converted into a gray scale image. All the necessary operations were performed after converting the image into gray scale.

Color Detection: This is the most important step in the whole process. The red, green and blue color object is detected by subtracting the flipped color suppressed channel from the flipped GrayScale Image. This creates an image which contains the detected object as a patch of grey surrounded by black space.

Conversion of Gray scale Image into Binary Scale Image: The grey region of the image obtained after subtraction needs to be converted to a binary image for finding the region of the detected object. A grayscale image consists of a matrix containing the values of each pixel.

Finding Centroid of an Object and Plotting Bounding Box: For the user to control the mouse pointer it is necessary to determine a point whose coordinates can be sent to the cursor. With these coordinates, the system can control the cursor movement. An inbuilt function in MATLAB is used to find the centroid of the detected region. The output of function is a matrix consisting of the X (horizontal) and Y (vertical) coordinates of the centroid. These coordinates change with time as the object moves across the screen.

- ✓ Centroid of the image is detected and a bounding box is drawn around it.
- ✓ Its co-ordinates are located and stored in a variable

VI. PROBLEM AND DRAWBACK

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. The system might

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run slower on certain computers with low computational capabilities because it involves a lot of complex calculations in a very small amount of time. However a standard pc or laptop has the required computational power for optimum performance of the system. Another fact is that if the resolution of the camera is too high then the system might run slow. However this problem can be solved by reducing the resolution of the image by making changes in the system.

VII. CONCLUSION

In this paper, an object tracking based virtual mouse application has been developed and implemented using a webcam. This technology has wide applications in the fields of augmented reality, computer graphics, computer gaming, prosthetics, and biomedical instrumentation. Furthermore a similar technology can be applied to create applications like a digital canvas which is gaining popularity among artists. This technology can be used to help patients who don't have control of their limbs. In case of computer graphics and gaming this technology has been applied in modern gaming consoles to create interactive games where a person's motions are tracked and interpreted as commands. Most of the applications require additional hardware which is often very costly. Our motive was to create this technology in the cheapest possible way and also to create it under a standardized operating system. Various application programs can be written exclusively for this technology to create a wide range of applications with the minimum requirement of resources

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