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The Development of a Gesture-Responsive Virtual Mouse

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Abstract:

Human-computer interaction is becoming more vital as computing power advances. Unfortunately, the widespread use of touch screens means that not every software can take advantage of this technology. An alternative to the conventional touch screen is an interaction module between the user and computer, such as a virtual mouse. The goal is to build a virtual human-computer interaction module, which will need the creation of a hand-tracking application for interacting with the system. This component may be used to build a gesture-based user interface between a person and a computer. Due to its potential uses in HMI and its cutting-edge aesthetic, this module is certain to get a great deal of press.

I. INTRODUCTION

As the technology is improving day by day, the importance of human computer interaction is rapidly increasing. But this technology is still in its nascent stage to be used on systems of different applications. A virtual mouse using hand gesture recognition is a system that allows users to give mouse inputs to computer without using actual mouse hardware. To the extreme, it can also be called as hardware because it uses a camera for tracking hands. A virtual mouse can usually be operated with multiple input devices, which may include an actual mouse or a computer keyboard. Many people had tried to define gestures but their actual meaning is still arbitrary. For a successful communication, a sender and a receiver must have the same set of information for a particular gesture.

As per the context of our project we calculate the movements of hands to define the movement of mouse pointer and use gesture recognition to perform

Various mouse events. The primary step in gesture recognition systems is the detection of hands and the segmentation of the corresponding image regions. This segmentation is crucial because it isolates the task-relevant data from the image background, Computer Vision Techniques for Hand Gesture Recognition before passing them to the subsequent tracking and recognition stages. Various methods have been proposed in the literature that utilize a several types of visual features and, in many cases, their combination. Such features are skin color, shape, motion and anatomical models of hands.

II. LITERATURE REVIEW

TABLE I

EXISTING SYSTEM AND DRAWBACKS

No	AUTHORS	DESCRIPTION	DRAWBACKS
1	Angel, Neethu P S	Real-Time Static and Dynamic Hand Gestures Recognition	The hand tracking has to be specifically adapted for each user. This system was implemented only in a restricted to the indoor environment. This system is prone to noise and sensitive to the change of the illumination.
2	J.L. Raheja, A.Chaudhary, K.Singal	Proposed using hsv algorithm but this uses special sensor kinect to capture image and processes it.	User has to spend more money for the sensor.
3	Abhik Banerjee, Abhirup Ghosh	Mouse Control using a Web Camera based on Colour Detection	The presence of other coloured objects in the background might cause the system to give an erroneous response. If the resolution of the camera is too high then the system might run slow.

III. PROBLEM STATEMENT

Generally for personal use in computers and laptops we use a physical mouse or touchpad's invented a long time ago and in this project requirement for external hardware is completely eliminated by using human computer interaction technology we detect hand movements and gestures for mouse movements and mouse events.

IV. PROPOSED SYSTEM

The proposed system makes use of the webcam for tracking the user's hand and to recognize the gestures for the purpose of interaction with the system. The threshold boundary is introduced for faster detection of hand and recognition of gestures. Mouse activities are done by recognizing the gestures. The work will be extended for real time tracking and additional mouse activities. To solve the problems, a system can be used called Gesture Recognition System. A primary goal of this gesture recognition is to create a system which can identify specific human gestures and use them to convey information to control traffic signals as per traffic controller's wish and also for controlling the mouse. Fig 1 shows the flow of the system.

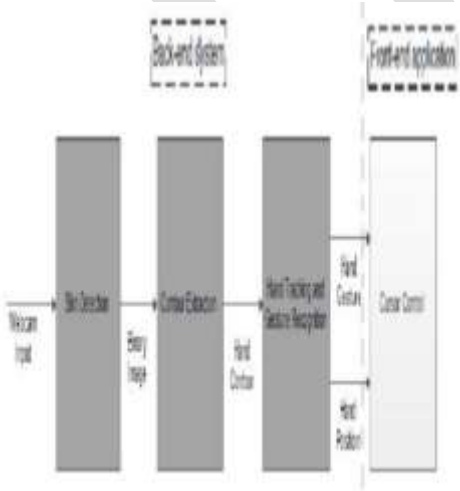

Fig 1 Block Diagram the various steps involved in the proposed system is explained as follows:

A. Web Camera

The purpose of Web camera is to capture the human generated hand gesture and movements store its image in memory. The package called Java Media Framework is used for storing image in memory and again calling the same program after particular interval. From this image we capture mouse events and movements.

B. Skin Detection

Skin detection is the process of finding skin-colored pixels and regions in an image or a video .A skin detector typically transforms a given pixel into an appropriate color space and then uses a skin classifier to label the pixel whether it is a skin or a non-skin pixel.

C. Contour Extraction

To find the movement information, the input data is assumed to be non-stationary or moving. When hands move in the spatial-time space, sequence of an image is generated, motion detector is able to track the moving hand by examining the local gray-level changes.

D. Hand Tracking and Gesture Recognition

A real time hand gesture tracking technique which can track the moving hand and then extract the hand shape from complex background. It is a simple and reliable method developed as a real-time image processing subsystem. This method is robust and reliable in complex background. For tracking the moving hand and then for extracting the hand shape fast and accurately, the tradeoff between the computation complexity and robustness need to be considered.

E. Event Handling

After successful identification of gestures next task is to assign an event to each of the gestures. This includes controlling mouse, performing its various applications like scroll, drag, select, click and pasting any folder from one place to another, both left and right clicks and scrolling.

V. ALGORITHM DESIGN

Algorithm is HSV which stands for hue, saturation, and value; it is also often called as HSB (*B* for brightness). HSV algorithm is simple transformations of device-dependent RGB models, the physical primary colors they define depend on the colors of the red, green, and blue primaries of the device or of the particular RGB space, and on the gamma correction used to represent the amounts of those primaries. At the end, each unique RGB object has unique HSL and HSV absolute color spaces to accompany it (just as it has unique RGB absolute color space to accompany it), and the same numerical HSL or HSV values (just as numerical RGB values) may be displayed differently by different devices. The HSB or HSV, model describes colors in terms of hue, saturation, and value (brightness).Hue corresponds directly to the concept of hue in the Color Basics section. The advantages of using hue are the Relationship between tones around the color circle is easily identified. Shades, tints, and tones can be generated easily without affecting the hue. Saturation corresponds directly to the concept of tint in the Color Basics section, except that full saturation produces no tint, while zero saturation produces white, a shade of gray, or black. Value

corresponds directly to the concept of intensity in the Color Basics section. Pure colors are produced by specifying a hue with full saturation and value. Shades are produced by specifying a hue with full saturation and partial value. Tints are produced by specifying a hue with partial saturation and full value. Tones are produced by specifying a hue and partial saturation and value. White is produced by specifying zero saturation and full value, regardless of hue. Black is produced by specifying zero value, regardless of hue or saturation. Shades of gray are produced by specifying zero saturation and partial value. One of the biggest advantages of HSV is that each of its attributes corresponds directly to the basic concepts of color, which makes it simple.

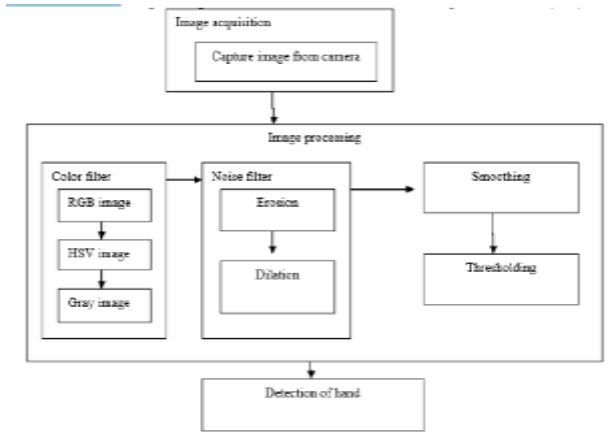

Fig 2 HSV Model

A single web camera is used to capture a series of images. Image acquisition is the creation of photographic images, such as of a physical scene or of the structure of an object .The term is often assumed to imply or include the processing, compression, storage, display of such images.

B. Color filter

An improved color based segmentation technique was applied to segment the skin areas in a picture and use of skin based segmentation in face recognition. An essential part is skin-color pixels assumed in finding appearances in colored images and chromaticity estimations of distinctive color spaces could be productively utilized for the information picture or image. The pictures that are taken from the camera are in the format of RGB that are converted in to HSV values and then other operations are performed. Segmentation of the color image was done into skin and non-skin areas are the first stage of face detection. They divided image segmentation in to four kinds' pixel, edge, region and model based on specific application and working environment. The diversity of color spaces provides the ability to select the proper color space that can be utilized well under different environment conditions.

C. Image processing

Signal processing is another form of image processing for which the data is an image, such as photos, frames of video etc. The result of image processing can be either an image or a set of characteristics or parameters related to the image. Many of algorithms for image-processing techniques involve using the image as a two dimensional signal

and applying standard signal processing techniques to it. Image processing usually refers to DIP digital image processing, but optical and analog image processing is also possible. In this project image processing refers to splitting each and every pixel of the image into RGB components. Erosion will remove the unwanted details or background and the dilation will load the defects to get interested area (hand).

D. Thresholding

After extracting the region that is moving object, the thresholding on the frame difference can be applied for the extraction of the possible moving region in complex background. Traditional thresholding methods, such as Ostu thresholding are not suitable for the case of detecting motion difference. Instead, a simple thresholding technique is used to extract moving regions.

VI. CONCLUSIONS

This study presents a replacement for the mouse and touchpad based on hand motion detection and image processing. Although it is challenging to acquire consistent results due to the wide range of lighting conditions and human skin tones, we may improve our accuracy by switching to a grayscale algorithm. Using this paradigm, we've created a program that allows users to do mouse-related actions such as clicking, scrolling, zooming, and more simply by making the appropriate hand gestures (e.g., displaying one finger to perform a single click and vice versa). The framework has potential use for a wide variety of user-controllable applications, including but not limited to video games, presentations, and computers with multiple screens, media player controls, and many more. In the future, we may use an infrared sensor to accurately recognize hands even in low-light circumstances and improve the algorithm for quickly detecting hands and gestures. Artificial intelligence may also be incorporated to tailor the system's response to individual users.

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