Virtual mouse using sixth sense technology

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*Abstract--*Since, people nowadays are highly dependent on the technologies and so do the interaction between computer and humans are increasing tremendously. The more the interaction between us becomes physical the less tedious it become. A person in an i.t firm who has to sit in front of the computer all day long, it's like a boon for them. Since, they can use the gesture for their feasible interaction. In this paper we have proposed the idea of virtual mouse using sixth sense technology since it uses gestures for its interaction making it highly responsive in real time.

Keywords—Virtual Mouse; Color Markers; Images;

I. INTRODUCTION

In today's world it is impossible to remain inseparable from digital device interface. In this technological environment many technologies are developing day by day. One of those technical concepts is human–device interface. In wired mouse, the main disadvantage is it is not portable and it must be plugged into the power outlets in order to function. These hard-wired requirements can make arranging personnel, furniture and equipment difficult. Employees are restricted interaction in their work location while using wired office products. Even in case of wireless mouse you need a surface to use your mouse and you cannot move beyond certain limits as we know the distance limit of wireless mouse is maximum 50 feet. Where by using virtual mouse you can do all the functions without having interaction with any of physical devices. We have explored low cost but high performance hand gesture controlled virtual mouse.

In this project we have been using color tapes for object recognition. Left and the right click events of the mouse have been achieved by detecting the distance between thumb and index finger, thumb and middle finger respectively. Humans communicate mainly by vision and sound, therefore, a man-machine interface would be more intuitive if it made greater use of vision and audio recognition.

Another advantage is that the user not only can communicate from a distance, but need have no physical contact with the computer. In this project will be using next generation features i.e.Detection of the pointer using the defined color information for controlling computer functions Dial pad control (Can dial number and can make a call and talk), Mouse movement control with clicks, Capture of image, Power point slide control. These features can be implemented using image processing.

II. COMPONENTS

A. Webcam

It is an important device used in working of virtual mouse. It is used to capture the images of the gestures which are further processed and used as commands by the system. Sensitivity of the mouse totally depend on the resolution of the camera. Hence the resolution of the camera should be good enough to guarantee enhanced user experience [4].

B. Color Markers

Color makers are primary requirement of user. Different color markers are used for different commands. We stick these color markers around our different fingers. Due to the clear distinction of the colors it will be faster and easier for the algorithm to process [4].

C. GSM Module

GSM module is used to call or send messages to the number of the person fetched in the code using at command. The user can organise this features also using the gestures.

III. TOOLS USED

A. Image Acquisition toolbox

The Image Acquisition Toolbox is a set of functions that enhance the graphics capability of the MATLAB. The toolbox supports a large no. of image acquisition operations. This tool enables us to connect with variety of scientific cameras to MATLAB. Basically all we can do with the image acquisition toolbox is, we can acquire the images and videos.

B. Image processing Toolbox

It provides set of standard algorithms and functions for image processing, analysis, visualization, and algorithm development. You can perform image improvement, image de-blurring, noise pruning, image division, geometric conversion, and image registration.
Image Processing Toolbox supports a various set of image types, including binary images, fluoroscopic image, Gray-scale images, Indexed images, RGB images. Using visualization functions we can understand an image, calculate region of pixels, adjust the contrast, and create contours or histograms and make changes according to our interest field. With the help of toolbox algorithms you can repair degraded images, study shapes and textures, and adjust color balance.

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C. GUI Builder:

A graphical user interface (GUI) is also known as a graphical designer display in one or more windows containing *components* that enable a user to perform collaborative tasks. The user of the GUI does need to create a script or type commands at the command line to perform certain tasks. GUI components include menus, toolbars, push buttons, radio buttons, list boxes, sliders, static elements, axes etc. By using MATLAB GUI tools can also perform any type of computation, read and write data files, communicate with other GUIs, and display data as tables or as plots.

IV. PROPOSED SYSTEM

This paper collects all the drawbacks of the previous system and tries to integrate the solution for them. The proposed system enables the user to interact with the computer and computer applications with the help of gestures. Thus providing them convenience by extending the feature of calling and messaging using GSM modem. The flow of work of the system proposed by us is as follow
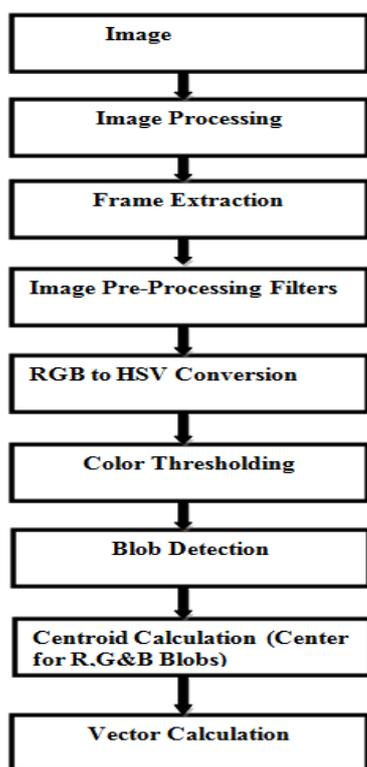

Fig: 1work flow diagram

A. Image

Image is a replica of object or a scene which one can see. It is a 2D light intensity function f(x, y), where x and y denotes spatial co-ordinates. And that value of function at any point (x, y) is proportional to the brightness of the image at that point .

B. Image Processing

In image processing it takes image as a input. In image processing we are using web cam as a input device. Web cam is a hardware device which is used to capture the video.

1. Image acquisition: in image acquisition, digitizer will convert the signals derived from the web cam into an array of numbers (digital form).
2. Image preprocessing: preprocessing is done to improve the image. It will deals with technique of removing noise and improving contrast of color of image.

C. Frame Extraction

As yellow and red colour is detected, further step is to extract the single frame. One should take care about processing speed of each image, as every camera has number of frames per seconds. In this step we are going to extract the key frame out of the series of frame which we have got from the video taken by the web cam using win video software.

D. Image Preprocessing Filter

Here the aim of preprocessing is an improvement of image data that suppressed the unwanted distortion or enhances the quality of the image. Basically, nearby pixels subjected to one object in real images have the similar brightness value, thus displaced pixels can be reimpose as total value of nearby pixels.

E. RGB to HSV Conversion

In RGB color space, the colors are defined in the amount of red, green and blue whereas, In HSV color space, the colors are defined in the amount of hue, saturation and value. The digital camera is used to capture the RGB values. The camera converts this RGB values into HSV values after reading it. The HSV values are then used in the code to find the location of object or say color.

The *R, G, B* values are divided by 255 to change the range from 0...255 to 0...1

$$R' = R/255$$
$$G' = G/255$$
$$B' = B/255$$
$$C_{max} = \max(R', G', B')$$
$$C_{min} = \min(R', G', B')$$
$$\Delta = Cmax - Cmin$$

Hue calculation

$$H = \begin{cases} 0° & \Delta = 0 \\ 60° \times \left(\frac{G'-B'}{\Delta} mod6\right) & ,C_{max} = R' \\ 60° \times \left(\frac{B'-R'}{\Delta} + 2\right) & ,C_{max} = G' \\ 60° \times \left(\frac{R'-G'}{\Delta} + 4\right) & ,C_{max} = B' \end{cases}$$

Saturation calculation

$$S = \begin{cases} 0 & ,C_{max} = 0 \\ \frac{\Delta}{C_{max}} & ,C_{max} \neq 0 \end{cases}$$

Value calculation:

$V = Cmax$

F. Thresholding

It is a special case of segmentation where $r=r_2=T$ and the output image becomes binary. It is simple and effective way of partitioning the image into foreground from the background. According to prescribed threshold value T , each grey level that is less than equal to T is changed to zero and each grey level greater than T is changed to L-1.Threshlding is useful when one wants to separate bright objects interest from a darker background or vice versa[3]. If the original image is denoted by $F_1(x, y)$ and the new image i.e. threshold image by $F_2(x, y)$ then,

$$F_2(x, y) = \begin{cases} 0 \text{ if } F_1(x, y) \leq T \\ \\ L\text{-}1 \text{ if } F_2(x, y) > T \end{cases}$$

Where L is the number of grey levels [3].

G. Blob Detection:

Its aim is to differentiate region in a digital image which differ to each other on the basis of brightness, properties and color when compared to the remaining surrounding. It can be said that in a image, blob is region in which some properties are constant or approximately constant.

The process is as follow, Filter with Gaussian at different scales, in this there is repeated filtering with the same Gaussian. Then the filtered image at one scale is subtracted with the filtered image at previous scale. Find out the local extreme, this pixel is bigger/smaller than the eight neighbor pixels. The characteristic scale of a blob is the scale that produces peak of Laplacian response in the blob center.
$L = \sigma\ 2\ (G\ (x,\ y,\ \sigma) + G\ (x,\ y,\ \sigma))$ xx yy x y x y D G (k(Laplacian)

$DoG = x, y, k\sigma) - G(x, y, \sigma)$, difference of Gaussian.
For efficient implementation, their difference is considered [1].

H. Centroid calculation:

Thus, we calculate the centroid of the largest blob detected. After the centroid of the blob is calculated, the Centroid is treated as the pointer of the mouse. After that the mouse acts as a robot. Then we can operate the system with the help of the gestures.
To calculate the centroid of the blob [2], the formula is

$$x = \frac{1}{n} \cdot \sum_{k=1}^{n} x_k$$

$$y = \frac{1}{n} \cdot \sum_{k=1}^{n} y_k$$

I. Vector calculation:

Vector calculation basically means the coordinates of last few locations that give us information about patterns. On calculation of vectors proper actions or events can be executed or performed.

V. FUTURE SCOPE

While the system works fairly well for the simple pointing and pinching gestures, there is still room for improvement. Currently the system assumes a static background, but it would be desirable to use this hand tracking system in an augmented reality setting where a user, wearing a head-mount display, could interact with virtual 3D objects in the real-world. In other words, the cameras would be attached to the head-mount display and viewpoint could thus be controlled by natural head motions, resulting in a changing background scene.

If the skin pixel detector could be made more robust, it would be possible to completely discard the background subtraction phase and use the current system in such an augmented reality setting. However, a more sophisticated hand segmentation system would still be required in order to differentiate between other objects with skin-colored pixels, such as faces.

A. Future Enhancements:

1. To get rid of color markers.
2. It should allow us to touch the table as multi touch user interface.
3. Implementing this technology in various fields such as education, gaming, etc.
4. To have 3D gesture tracking.
5. For disabled people, the sixth sense should work as fifth sense.

VI. CONCLUSION

This project presented a vision-based hand tracking system with the help of markers and can operate in real-time on a commodity pc with low-cost cameras. Specifically, the system can track the tip positions of index finger and the middle finger, assuming that a calibrated pair of cameras is viewing the hands from above with the palms facing downward.

The motivation for this hand tracker was a desktop-based Pranav Mistry's sixth sense technology in which a user can physically interact with the computer applications in real-time using natural hand motions. The algorithmic details for the hand tracker were presented, followed by a discussion of the performance and accuracy of the system, as well as a discussion of how the system could be improved in the future.

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