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GESTURE MOUSE CURSOR CONTROL USING OPEN CV

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ABSTRACT

In this paper we present an approach for Human computer Interaction (HCI), where we have tried to control the mouse cursor movement and click events of the mouse using hand gestures. Hand gestures were acquired using a camera based on colour detection technique. This method mainly focuses on the use of a Web Camera to develop a virtual human computer interaction device in a cost effective manner.

The proposed system uses nothing more than a low resolution webcam that acts as a sensor and it is able to track the users hand bearing colour caps in two dimensions. The system will be implemented using the python and OpenCV. The hand gesture is the most effortless and natural way of communication. The output of the camera will be displayed on the monitor. Shape and position information about the gesture will be gathered using detection of colour. The file transferring scheme is implemented by using the python server programming.

I. INTRODUCTION

The most efficient and expressive way of human communication is through hand gesture, which is a universally accepted language. It is pretty much expressive such that the dumb and deaf people could understand it. In this work, real-time hand gesture system is proposed. Experimental setup of the system uses fixed position low-cost web camera high definition recording feature mounted on the top of monitor of computer or a fixed camera on a laptop, which captures snapshot using Red Green Blue [RGB] colour space from fixed distance. This work is divided into four stages such as image pre-processing, region extraction, feature extraction, feature matching. Recognition and the interpretation of sign language is one of the major issues for the communication with dump and deaf people. In this project an effective hand gesture segmentation technique has been proposed based on the pre-processing, background subtraction and edge detection techniques. Pre-processing is defined as procedure of formulating data for another process. The main objective of the pre-processing process is to transform the data into a form that can be more effectively and effortlessly processed. In the proposed work, the pre-processing techniques are created on the basis of different types of combinations from the subsequent hand gesture image processing operations such as capturing image, removing noise, background subtraction, and edge detection and these image processing methods are discussed initially, the hand gesture images are captured from the vision based camera, The hand gestures can be observed with the different kind of interfaces like “data gloves” that accurately records every abduction angles and digit’s and position sensors for wrists and optical orientation or electromagnetic, requiring the user to wear trackers or gloves. Habitually, the glove-based interfaces even need the user to be hitched to the computer, all minimizing time to user comfort and interface, conversely, vision based interfaces offer unencumbered interaction with human. By this paper we are aiming in creating a cost free hand recognition software for laptops and PCs with a web-cam support. The project covers as a hand recognition tool which could be used to move the mouse pointer, perform simple operations like clicking and other hand gesture operations like moving file from computer to computer through delicate socket programming and performing simple but fascinating operations that could be covered with the hand recognition.

II. LITERATURE SURVEY

[1] Erden et al have used camera and computer vision technology, such as image segmentation and gesture recognition, to control mouse tasks.

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[2] Hojoon Park Our project was inspired by a paper of Hojoon Park where he used Computer vision technology and Web camera to control mouse movements. However, he used fingertips to control the mouse cursor and the angle between the thumb and index finger was used to perform clicking actions.

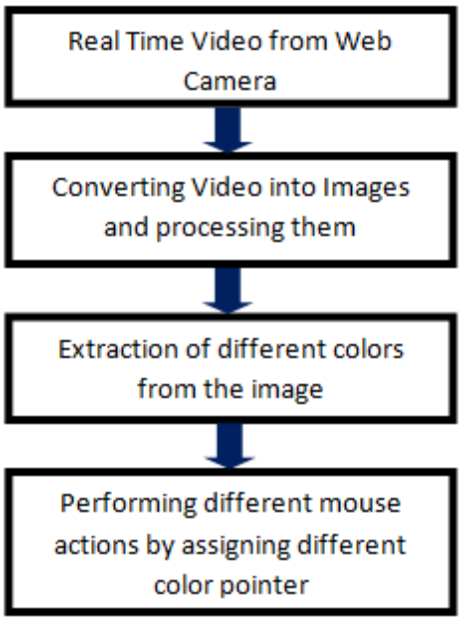
[3] Chu-Feng Lien used an intuitive method to detect hand motion by its Motion History Images (MHI). In this approach only fingertip was used to control both the cursor and mouse click. In his approach the user needs to hold the mouse cursor on the desired spot for a specific period of time for clicking operation.

[4] Kamran Niyazi used a Web camera to detect color tapes for cursor movement. The clicking actions were performed by calculating the distance between two colored tapes in the fingers.

[5] K N Shah have represented some of the innovative methods of the finger tracking used to interact with a computer system using computer vision. They have divided the approaches used in Human Computer Interaction (HCI) in two categories: 1. HCI without using interface and 2.HCI using interface. Moreover, they have mentioned some useful applications using finger tracking through computer vision.

Our Proposed Approach

FLOW CHART



III. WORKING

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 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
- Processing of individual Frames

Flipping of Images:

When the camera captures an image, it is inverted. This means that if we move the colour pointer towards the left, the image of the pointer moves towards the right and vice-versa. 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 colour channels of the image are separated and then they are flipped individually. After flipping the red, blue and green coloured channels individually, they are concatenated and a flipped RGB image is obtained.

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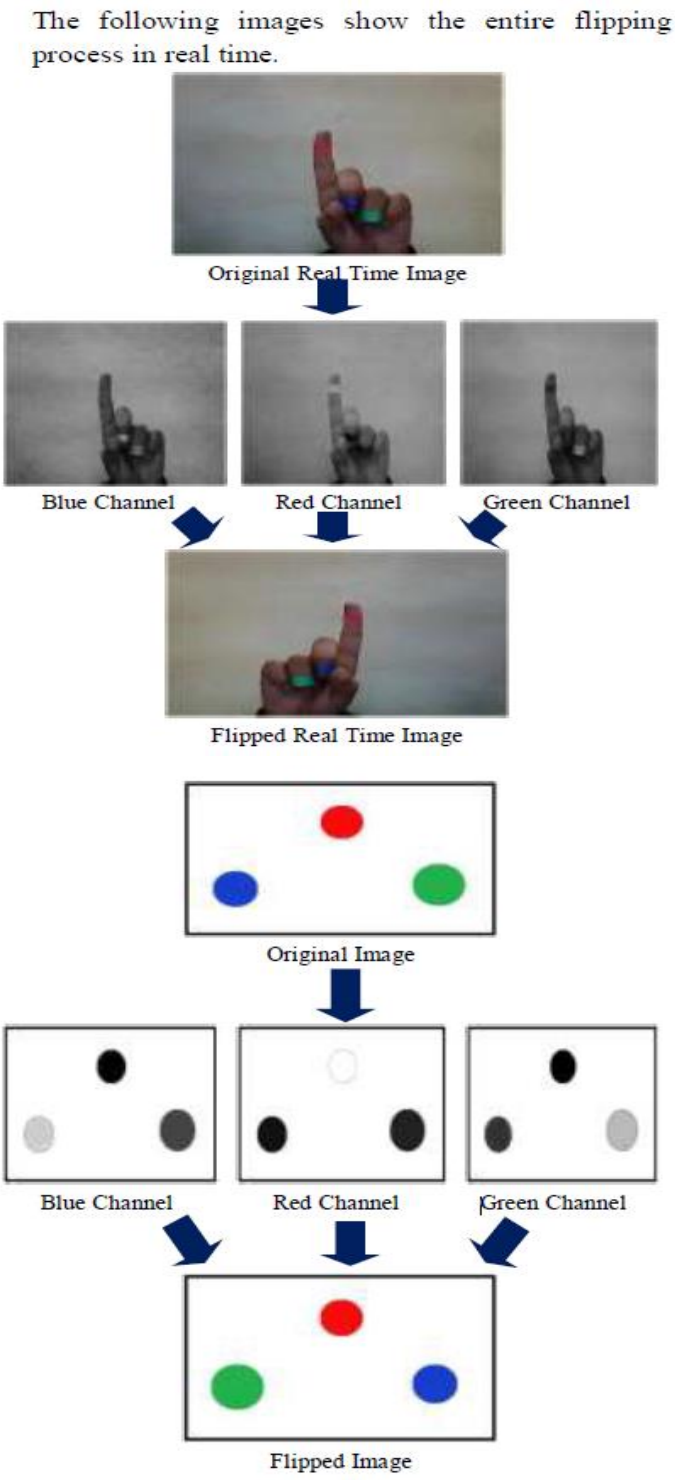
Flipping of real Time Image :



Conversion of Flipped Image into Gray scale Image:

As compared to a coloured 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.

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Colour Detection:

This is the most important step in the whole process. The red, green and blue colour 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.

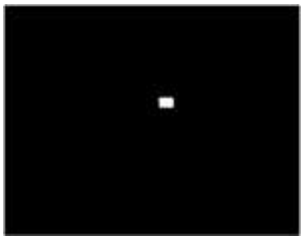
Flipped Red Channel

Flipped Gray-Scale Image

Extracted Red Color

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. The pixel values lay between the ranges 0 to 255 where 0 represents pure black and 255 represents pure white colour. We use a threshold value of 20% to convert the image to a binary image. This means that all the pixel values lying below 20% of the maximum pixel value is converted to pure black that is 0 and the rest is converted to white that is 1. Thus the resultant image obtained is a monochromatic image consisting of only black and white colours. The conversion to binary is required because python can only find the properties of a monochromatic image.



Detected Region

Finding Centroid of an object and plotting:

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 PYTHON 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
- Its co-ordinates are located and stored in a variable

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Tracking the Mouse pointer:

Once the coordinates has been determined, the mouse driver is accessed and the coordinates are sent to the cursor. With these coordinates, the cursor places itself in the required position. It is assumed that the object moves continuously, each time a new centroid is determined and for each frame the cursor obtains a new position, thus creating an effect of tracking. So as the user moves his hands across the field of view of the camera, the mouse moves proportionally across the screen.

IV. METHODOLOGY OF EVALUATION

Following are the steps in our approach:

1. Capturing real time video using Web-Camera.
2. Processing the individual image frame.
3. Flipping of each image frame.
4. Conversion of each frame to a grey scale image.
5. Color detection and extraction of the different colours (RGB) from flipped gray scale image
6. Conversion of the detected image into a binary image.
7. Finding the region of the image and calculating its centroid.
8. Tracking the mouse pointer using the coordinates obtained from the centroid.
9. Simulating the left click and the right click events of the mouse by assigning different color pointers

V. HARDWARE AND SOFTWARE

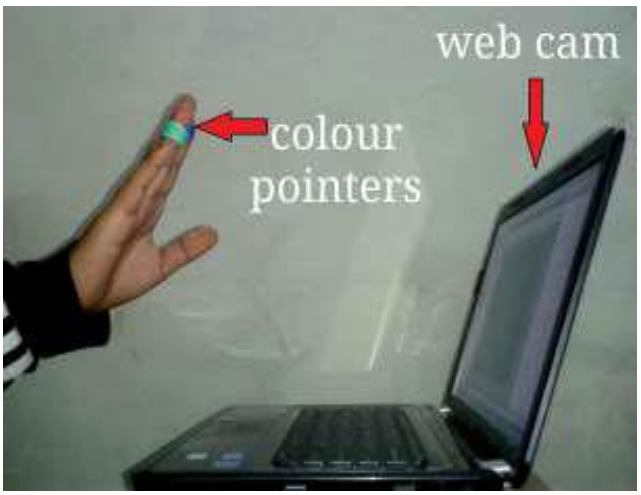
Hardware

- Laptop with webcam
- RAM 4GB

Software

- Windows 7/8/10/11
- Python 3.7.4

VI. RESULT



VII. CONCLUSION

In this module a system for hand gesture identification is developed. The main objective of the study is to develop a system that can recognize the human generated gestures and make use of this data for gadget control and various operations on image restorations. This system is aimed to make access the system environment simpler so that the person who is unaware about the system can handle it with few simple gesture commands. This system is very useful for the physically disabled users who lack the strength and precision used to operate the traditional input devices. In future, Using gestures like eye blinks, head motions, hand gestures would help them to communicate effectively.

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