

# VIRTUAL MOUSE USING HAND GESTURE

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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. As the computer technology is growing up, the importance of human computer interaction is rapidly increasing. Most devices use Touch screen technology which cannot be affordable to all the applications. A virtual human based Computer interactive module such as virtual mouse, can be an alternative way for the traditional touch screen.

**Keywords:** Hand Gesture, HumanComputer Interaction (HCI), Segmentation, Feature Extraction, open CV

## I. INTRODUCTION:

In today's world, the computers have become an important association in life and are used in various fields however the systems and methods that we use to interact with computers are traditionally old and have various issues. Hence, a very new technology trying to develop new patterns of interaction with the new era of technology progress in the name of the field trying to overcome these issues has emerged namely Human Computer Interactions (HCI) or in common terms we can call it "Touchless interaction". Although, computers have made numerous advancement in both fields of Software and Hardware, Still the basic way in which Humans interact with computers remains the same, by sending commands or set of instructions to it by using basic pointing device (mouse), Keyboard or advanced Voice Recognition System, or maybe Natural Language processing in really advanced cases to make this communication more human and easy for us.

Our proposed Project is the Hand gestures recognition system or Touch less interaction to replace the basic physical interaction pointing devices used in computer systems to reduce the limitations that stay due to the legacy systems such as mouse and Touchpad. The proposed system uses hand gesture, mostly hand region is physically raised within the region of Interest to perform various operations such as some basic and repetitive functions to access various applications like scroll up and down, left click and right click and free movement etc. The proposed system can be used to control various soft panels like HMI systems, Robotics Systems, Telecommunication System, using hand gestures with help of programming by within python using pyautogui module to facilitate interaction within different functions of computer through the Camera to capture video frames.

## II. BASIC TERMINOLOGY:

### A. Human Computer Interaction

It is the field of study of focusing design of computer technology with the aim of the interaction between humans and the computers, it touches domains of computer science, human factors engineering and cognitive science.

### B. Gesture Recognition

It is the topic in computer science with the aim of achieving the goals of understanding the human gesture with the help of the required algorithms, it uses camera to see the gesture of the user and running algorithm behind the input gesture to follow out the desired performance

### C. OpenCV

OpenCV is a cross platform library using thus we can develop real time computer vision applications using the webcam of the machine on which it is installed. It mainly focuses on image processing, capturing video frames and processing various operations like image acquisition, pre processing, feature extraction, contour detection, detecting the number of fingers is raised using the pyautogui module.

### D. RGB Colour Model:

The RGB colour model consists of the primary colours red, green, and blue combined together in various ways to obtain an array of colours. Its aim to display in monitor the input gesture through these three primary colours for specific function.

**E. HSV Colour Model:**

It is the alternative views of RGB colour model. the HSV colour model stands for hue, saturation and lightness respectively. This colour space describes colours in terms of shade and brightness value. using this concept, an object with certain colour can be detected and intensity of light can be changed.

**III. APPLICATION OF HAND GESTURE RECOGNITION SYSTEM****A. Coffee for yawns:**

It can be used as a automation coffee service platform for the many peoples in an organization, passengers at airport, railways, metro and malls ,asking for a coffee by analysing their yawning gestures(How can one ignore for a coffee). The people who were tired or having some sort of work pressure obtain a cup of coffee with the help of facial recognition software to dispense a free cup of coffee when anyone yawns.

**B. Switching channels without a TV Remote:**

It is the new way of interacting with the TV without searching for a remote anymore or for the batteries in remote. With the help of the gesture recognition on the screen with the help of the in build or externally implemented cameras the interaction with the system can be made and recognised with the help of some specific gestures towards the TV in order to change channels or numbering the channel number to switch in between channels.

**C. Automated Homes:**

It is also new way of interacting with the homes, in this we will reduce burden on the switch buttons to control the fans, lights, coolers, security systems of homes. Just with the specific gesture we can control the basic home elements on and off modules of the home. We can also keep changing the gesture systems controls on the go with the help of some IOT devices. For every elements of the home we can have a specific type of gesture recognition systems using our fingers or faces.

**IV. ALGORITHM DESIGN****A. Data obtaining**

We need to take out a hand region alone by removing all unwanted background portions in the video sequence, this process is called segmentation. After segmentation process, we can count the fingers and set up the command with the help of python libraries and openCV frameworks to perform certain activities with specific gestures.

**B. Data Pre-Processing****1.Segmentation (hand region):**

Find the hand region by eliminating all unwanted portions in the video sequence.

**2. Background Subtraction:**

Background subtraction is a technique for separating foreground elements from the background while capturing frames and is done by generating a foreground mask. Foreground masking is used for detecting dynamically moving objects from static cameras, like detecting dynamic hand movement from static camera using Background subtraction technique which is important for object tracking and for gesture recognition.

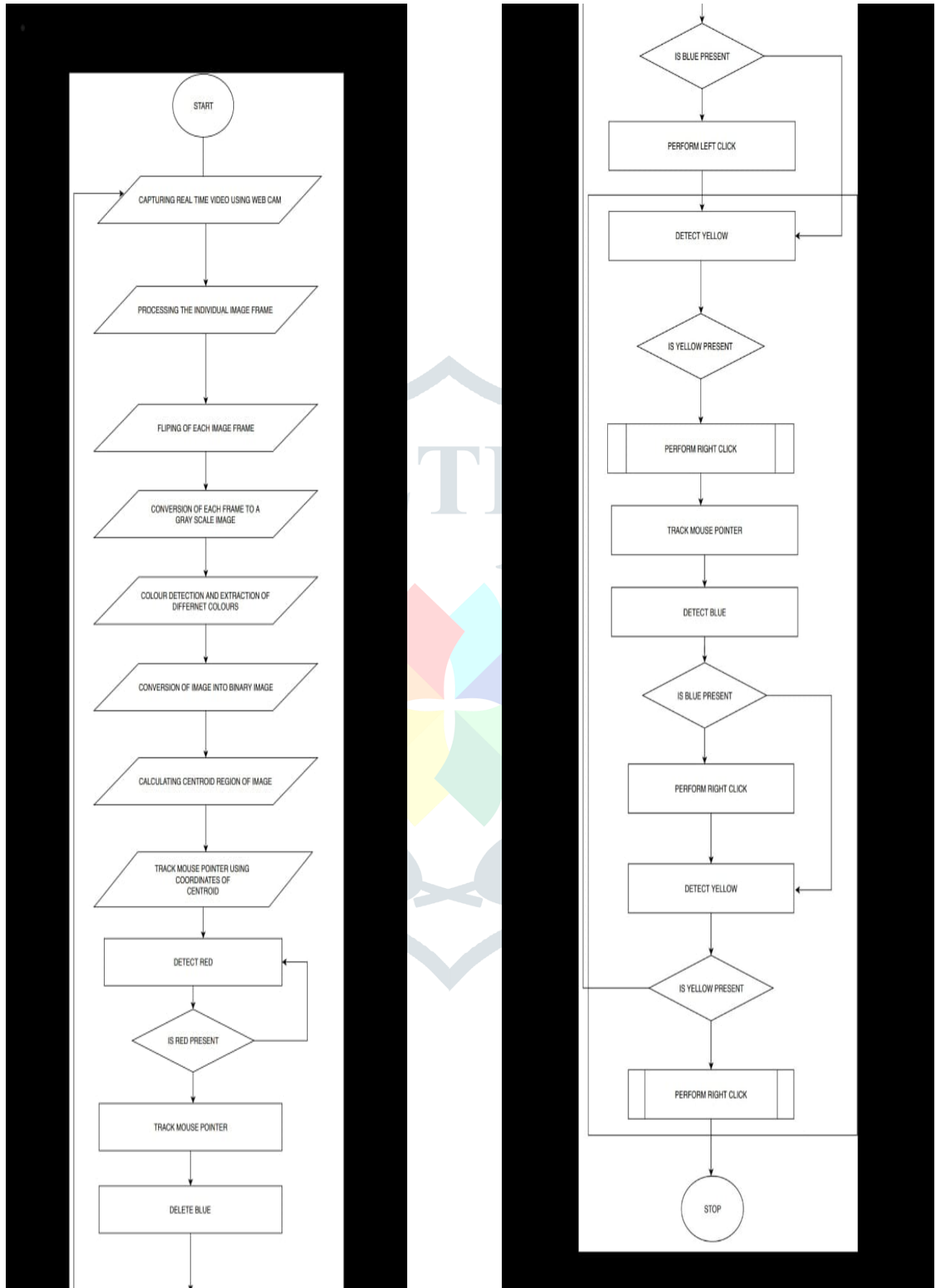
**3. Motion detection and Thresholding:**

To detect the hand region from we need difference image, we need to threshold the difference image, so that only our hand becomes visible and all other unwanted regions are painted as black. This is what Motion Detection is all about.

**4. Contour Extraction:**

Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same colour or intensity. The contours are a useful tool for shape analysis and object detection and recognition. The **contours** are the continuous lines or curves that bound or cover the full boundary of an object in an image. To draw the contour basically cv2. contours() function will be used. Its first argument is source image, second argument is the contours which should be passed as a Python list, third argument is index of contours.

V. GESTURE RECOGNITION ALGORITHM USING VIRTUAL MOUSE:



## VI. PROPOSED SYSTEM

Using the current system even-though there are a number of quick access methods available for the hand and mouse gesture for the laptops, using our project we could make use of the laptop or webcam and by recognizing the hand gesture we could control mouse and perform basic operations like mouse pointer controlling, select and deselect using left click. The project done is a “Zero Cost” hand recognition system for laptops, which uses simple algorithms to determine the hand, hand movements and by assigning an action for each movement. But we have mainly concentrated on the mouse pointing and clicking actions along with an action for the file transfer between connected systems by hand action and the movements. The system we are must process for mouse to be called as virtual mouse.

The actual flow is as follows:-

- Image is captured by a high resolution web camera provided with the necessary conditions for capturing images.
- Web camera will take a few shots after fixed time interval and then those shots will be processed further.
- Image processing involve processing those individual frames of images as per the requirement.
- Image processing involves image resize which will map camera coordinates with screen coordinates, and image segmentation will be done and in image segmentation we would separate hand region from background.
- Particular frame that is extracted is in RGB color space so this particular frame is converted into YCbCr color space and then finally into binary image.
- Blob detection is technique of detecting points in an image that differ in brightness or in color as compared to their surroundings.
- Color thresholding is used for segmenting certain part of image from background image that falls under particular color range and this particular color segmentation is done for all three colour component.

Implementing which is been written in python code be much more responsive and is easily implemented since python is a simple language and is platform independent which is desirable for the program with a focus of creating virtual mouse. As our algorithm detect an image, it starts capturing frame and take out the current frames and feed as an input to next processes, for feature extraction (which is basically first step and backbone for remaining processes that depends on previous input),so these captured frames will be feed as input to other processes. Next phase accepts these captured frames and began extracting features such as edges and contours and once particular feature got extracted ,these will be further processed by various functions in opencv that need these features for performing desired action. particular mouse activity is defined for particular feature so extracting these particular features is

## VII. METHODOLOGY

One of the major problem in object detection is object tracking. So instead of hands color pointers are preferable for fast and easy object detection. Depending upon the relative positions of the three centroids, this function chooses whether the user desires free movement of cursor, left click, right click, dragging and scrolling.

### 7.1 Move the cursor

To make our cursor move virtually, we first have to calculate the centre of the detected objects it can be in any color, this can be easily done by taking the average of the object’s maximum and the minimum points. By this we found out 2 co- ordinates of the centre of the 2 objects and further we will find the average of that and we will get the red point shown in the image. We are converting the detected coordinate from camera resolution to the actual screen resolution, after this we set the location as the mouse position but moving the pointer may take time. This is for the open gesture.



FREE MOVEMENT

### 7.2 Mouse Click

Virtual mouse can be used to perform mouse clicks virtually on screen result of which is actually reflect on computer. This is the implementation of close gesture, this is similar to open gesture, the only difference is we have only one object so here we need to calculate the center of it with the help of centroid of the image formed.

### 7.3 Drag/Select

It is the most important and the centre of attraction feature in the virtual mouse, its main implementation is to select the file, image or folder from the destination and drag or place it to the desired path on the screen like arranging or sequencing normally.

### 7.4 Scroll

It is also the commonly used feature in the computer screen for carrying out various work outs in daily interaction routines with the computer systems. We had made gestures to carryout specific types of the Commands for scrolling with the help of finger recognition in real time scenario like page up and page down.



## VIII. CONCLUSION

The system architecture that has been proposed will completely change the way people would use the Computer system. Presently computer include webcam mouse and keyboard but our proposed methodology would eliminate dependency on mouse. This project will completely eliminate the necessity of mouse. Also this would lead to a new era of Human Computer Interaction (HCI) where no physical contact with the device is required. The use of object detection and image processing in openCV led to achieve mouse related activities with precision accuracy. Based on hand gesture recognition and image processing this paper provides an alternate solution for traditional existing mouse. However, it is quite difficult to get stable gestures as there are variety of lightning and colours of human but we still get better results by using grey scale model which reduces the difficulty.se of the variety of lighting and skin colours of human races but still we can get better results by changing algorithm using gray scale. Using this model we have developed an application where we can control mouse with the hand movement. The frame work may be useful for controlling different types of games and many other applications.

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