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# Raspberry-Pi Based Hand Glove

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**Abstract** - *Research in the field of Human Computer Interaction (HCI) has been spectacularly successful and has fundamentally changed computing. In the proposed system, a real time computer vision based interaction prototype is designed where hand gestures are used to control the movement of a mouse pointer using colour markers. This paper aims at providing a unique approach for a more reliable interaction between the user and the system. To avoid the limitations of personal computer, an embedded system consisting of Raspberry-pi with Linux based operating system is used. This approach uses the concepts of image processing like colour detection, background subtraction and bounding box technique.*

***Key Words***: **Raspberry pi, Centroid, Human Computer Interaction (HCI), Computer Vision Technologies, Hand Gesture, Image Processing.**

## 1. INTRODUCTION

In our daily life, vision and gestures are used by human beings for communication purpose and the same role is played by a mouse in graphic user interface based computers. So, a combined technology can be developed for better interactive system. Most of the recognition systems are PC based but PCs are heavy, power consuming and non portable. By designing a less power consuming and portable embedded system these disadvantages can be avoided.

"Raspberry-Pi Based Hand Glove" is a computer pointing interface which is used as an alternative to a mouse. A computer vision based system constantly monitors the hand and tracks the colour markers which are placed on fingers.

Mouse actions like pointer movement, right click and left click are performed using different colour codes on the fingers. Raspberry pi is a Linux based platform that mainly uses Python as a programming language. Software development on Linux is easy because it is an open source code development environment.

## 2. RELATED WORK

A. Erdem et al [2] used a mouse shaped passive device which has regions corresponding to buttons for clicking. But it did not completely eliminate the hardware mouse. Hojoon Park [3] implemented a system to control the mouse cursor using a real time camera and computer vision algorithms. However it was not able to get stable results because of the variety of lighting and skin colours of human races. Chu-Feng Lien [4] introduced an efficient method for hand motion recognition that could fit to a handheld device which requires the user to install a software program. But there were some limitations like high error rate on fast moving motion which will result in high false positive detection, less accuracy for highly distorted projected screen. Kamran Niyazi et al [5] presented a method for HCI by adding more buttons or changing the position of the tracking ball.

Our paper is based on the work of V. Upasana et al [1] where RGB colour tapes are used to carry out the actions usually done using a mouse by making use of only a camera and computer vision technologies with the help of MATLAB software. In our proposed idea we will instead make use of raspberry-pi which is a linux based processor that supports OpenCV software. Software development on such systems is easier.

## 3. SYSTEM DESIGN

Figure 1 shows the complete design of the system.It has five major steps. That are :

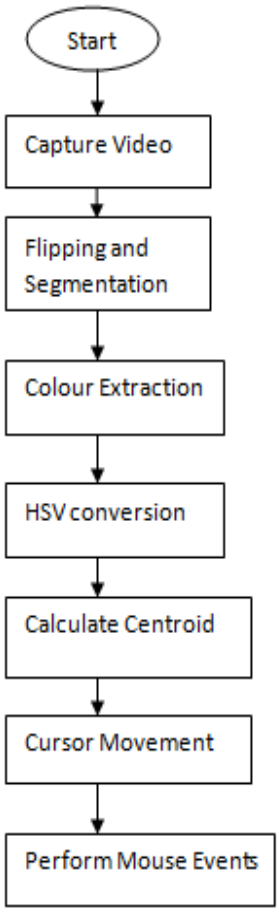


**Fig.1** System Flow

### A. Capture Video

This is the initial step where a real time video stream is captured which is used as an input to the system. We are using a 5 megapixel USB camera with a fixed resolution and frame rate. The input is captured in the RGB colour space.

### B. Video Flipping and Segmentation:

The captured stream is horizontally flipped that means if we move the pointer to right, the cursor will move towards left. Thus we have to flip it to avoid complication. Also the acquired video stream is divided into small segments for easy processing.

**Fig.2** Image Flipping

### C. RGB Colour Extraction:

When the segmentation is done, we have to extract the RGB colours from the input. For this we will be using the masking method. Masking will subtract the background from the captured frame. Only the colour that lies within the preset values will be detected rest of the frame will be black.

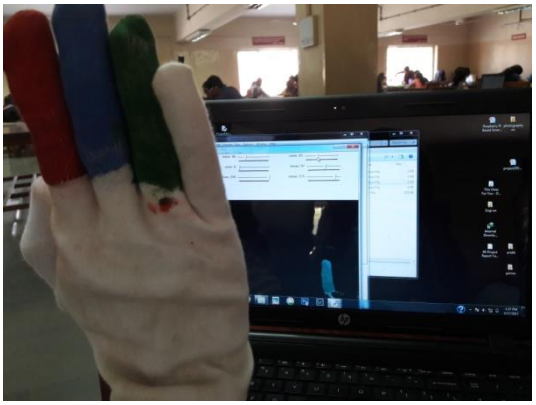

**Fig.3** Green Colour Detection

### D. HSV Conversion:

The input is in the RGB colour space. In the RGB colour space the colour is identified in terms of the amount of red, green, and blue content present in it. The HSV colour space describes colours in terms of the Hue and Saturation values. The HSV colour model is preferred over the RGB model because the HSV model describes colours similar to how the human eye tends to perceive colour. RGB defines colour in terms of a combination of primary colours, whereas, HSV describes colour using more familiar comparisons such as colour, vibrancy and brightness.

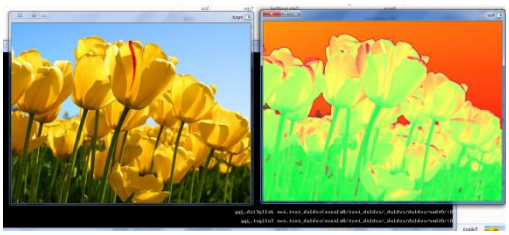

**Fig.4** RGB to HSV Conversion

### E. Calculate Centroid

To track the pointer centroid is calculated. The 'X' and 'Y' co-ordinates of the detected object will give the exact pointer location on the screen.

### F. Cursor Movement

After the colour red is detected; the co-ordinates of the corresponding position are obtained, these co-ordinates are then given to the cursor pointer. Now according to the values of the 'X' and 'Y' co-ordinates, the cursor attains its place on the screen. When the cursor is placed, it starts following the finger thus performing the action of cursor movement normally done using a mouse.

### G. Perform Mouse Events:

We are using Green and Blue colours for performing the mouse events i.e. left and right click. Whenever the blue is detected the right click action is performed and when the green is detected left click action will be performed.

## 4. CONCLUSION

The above proposed system will revolutionize the way user interacts with the computer. Since we are performing various mouse actions using only a camera, this will eliminate the use of handheld mouse or touchpad. Here we are using the HSV colour space, so the fluctuations in the light intensity will not affect the system much. Higher the resolution of the camera used higher will be the system throughput**.**

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