Virtual Mouse Using Hand Gesture

Neha Ramakrishnan[1], Mrs. Jena Catherine Bel[2]

[1]*Student, Computer Science and Engineering, Velammal Engineering, college, Chennai, India*

[2]*Assistant Professor, Computer Science and Engineering, Velammal Engineering, college, Chennai, India*

Abstract - : **Image Processing is a strategy to extract certain information from an image, so as a result it gets an upgraded image or some data can be extracted from the image. It is a kind of sign handling where input is an image and yield might be an image or qualities/highlights related with that image. These days, image processing is one among the quickly developing advancements. In this project hand gestures are used as a replacement of mouse. We will be using digital image processing in this project to retrieve necessary data from the image captured through the user's web camera and implement it to the mouse interface of the computer according to predefined functions. User can be calibrate the color ranges of the three finger caps individually. It can be calibrated separately for all the three colors at the starting of the program. The user is provided with a default setting as well. It detects the centroid of the three color and decides what mouse action has to be done on their relative positions. Based on the detection, corresponding actions will be choosed and the mouse functions will be performed using the Python specific library PyAutoGUI. We can perform actions like left click, right click, scroll up, scroll down and drag. A camera catches your video and relying upon your hand motions, you can move the cursor and perform left-click, right-click, drag, select and look here and there. The predefined motions utilize just three fingers set apart by various hues.**

Index Terms - **Centroid Detection, Gesture, Image Processing, Virtual Mouse.**

I.INTRODUCTION

Image Processing is a strategy to extract certain information from an image, so as a result it gets an upgraded image, or some data can be extracted from the image. It is a kind of sign handling wherein input is an image and yield might be an image or qualities/highlights related with that image. These days, image processing is among quickly developing advancements. It structures center research zone inside building and software engineering disciplines as well.

We will be using digital image processing in this project to retrieve necessary data from the image captured through the user's web camera and implement it to the mouse interface of the computer according to predefined functions. This project has been created using Python. It uses a cross-platform image processing module known as OpenCV and the mouse functions are implemented using a Python specific library known as PyAutoGUI

II. LITERATURE SURVEY

Computers have become important in our day-to-day life. Many methods are introduced for Human-computer interaction to enable as many to possibly access computers. New methods were discovered for the HCI. It made the system usable and made the users need to use them again Human computer interaction is the investigation of individuals, computer innovation, and the ways these impact one another. In any case, practically speaking Jacko et al characterize HCI as, "a control that includes the structure, assessment and execution of intuitive processing frameworks for human use. As indicated by Yee, HCI alludes to: "the manner in which a human and computer impart utilizing set of physical and coherent guidelines." Hence, Yee alludes to the manner in which an individual encounters computer framework. The HCI discipline has advanced for the most part because of two main impetuses to be specific: the developing idea of computers, and the craving for all the more remarkable and convincing client experience. The adjustments in human computer association have prompted moves in collaboration standards. Making a stride in reverse, during the 50s and 60s there was no genuine association worldview. Information was entered through switches or punched cards and yield was delivered through punched cards or lights. During the 70s, order line interfaces (typewriter worldview) were presented whereby communication was

distinctly through content. This association had issues of having inflexible conventions which restricted the intensity of computers. During the 80s the graphical client's interface (GUI) and the work area similitude in XEROX PARC were presented. This worldview is best depicted by the abbreviation WIMP (windows, symbols, menus, and a pointing gadget). Notwithstanding the work area worldview being extremely helpful for giving an immediate control style of cooperation, the two powers; the developing idea of computers and the longing for all the more remarkable and convincing client experience, have coordinated change in interface structure. HCI will in general be described by new methods for connection which are normal, versatile, natural and unpretentious and impersonate human-human correspondence. The presentation of such connection techniques has profited numerous clients incorporating those with engine weaknesses. In particular, structured are interfaces with a scope of sources of info and yields it gives. The accompanying area clarifies distinctive HCI frameworks whereupon an interface is based.

III. OBJECTIVE

The basic objective is to develop a virtual mouse and keyboard using the concepts of hand gesture recognition and image processing which will ultimately move the mouse pointer according to the hand gestures, similarly with the help of the gesture can use keyboard functions which will be defined as per the convenience of the user. Reducing the cost of hardware.

This approach will make tasks trickier and easier like creating 3D models, browsing the imaginary part in medical world during surgery and one best thing is that without touching anything it can work even in architectural designs and in automated building.

IV. PROPOSED SYSTEM

Mouse

The Mouse uses a convex hull process for its working, defects are captured or read, using this defects the functions of the mouse are mapped. The process of this image recognition process solely focuses on defects and conditional statements, the convex hull takes the gap of the fingers as defects, so it can be used for multiple gestures and mapping commands. The following steps are followed for the use for gesture recognition and its mouse functions

Here we are aiming to achieve a design that is easily portable and highly interactive. The designing phase is a very important contribution to the success of the outcome. This project is designed in a way, such that the design is very convenient to carry. This works with a web camera that is attached to a laptop, or a small portable web camera can also be placed at any part that feels convenient for the user. As the present-day input devices like mouse or keyboard require a table to place them, this project would be built as an integrated system, so it does not require extra space.

Usually, the images to be processed needs to be captured from a live streaming camera. OpenCV is a python package that provides a very simple interface for this process. Device index will specify the camera from which the video has to be taken. Usually, the built-in camera can be selected by passing 0 or -1. To select the secondary or external camera by passing 1. Images can be captured frame by frame after this process is done. The capture can be released at the end. We have to convert the captured video to grayscale. User can calibrate the color ranges of the three finger caps individually. It can be achieved calibrating the colors separately for all the three colors at the starting of the program. The user is provided with a default setting as well. The three centers of the colored fingertip location involves Finding contours in the mask with respect to that color range, Discard contours of unwanted areas using area filters, Finding the largest contour amongst the remaining ones and applying the method of moments to find its center. Then comes the step for defining the position of the cursor on the screen. The thumb, with yellow color, is responsible for the position of the cursor. It will be more biased towards the right considering a right-handed user and upper parts of the frame in order to improve comfort. The centers keep vibrating around a mean position due to vibrations of the hand and noise captured by the web camera. On scaling up, these vibrations create a lot of problem with the accuracy of the cursor position. Differential position allocation is used to reduce the shakiness of the cursor. New center is compared with the previous position of the cursor. If a difference is less than 5 pixels, it is usually due to noise. Thus, the position of the new cursor is inclined more towards the previous one.
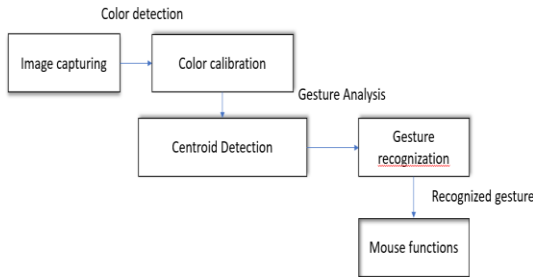
V. FLOW DIAGRAM

Fig.1.The Flow Diagram

In this project the program uses image processing to retrieve necessary data and implements it to the mouse interface of the computer to do the predefined mouse functions. Video captures by the webcam are processed and only the three colored fingertips are extracted. Their centers are calculated using a method of moments and depending upon their relative positions the action to be performed is decided. The three centers are sent to the program to decide what mouse action has to be done on their relative positions. We will be using digital image processing in this project to retrieve necessary data from the image captured through the user's web camera and implement it to the mouse interface of the computer according to predefined functions. User can be calibrate the color ranges of the three finger caps individually. It can be calibrated separately for all the three colors at the starting of the program. The user is provided with a default setting as well. It detects the centroid of the three color and decides what mouse action has to be done on their relative positions. Based on the detection, corresponding actions will be choosed and the mouse functions will be performed
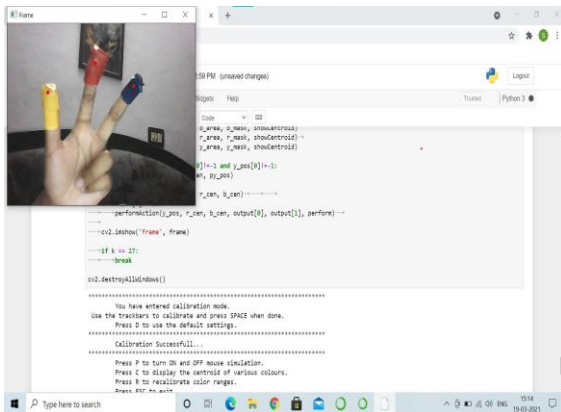
CENTROID DETECTION

Fig.2. Centroid of three colours
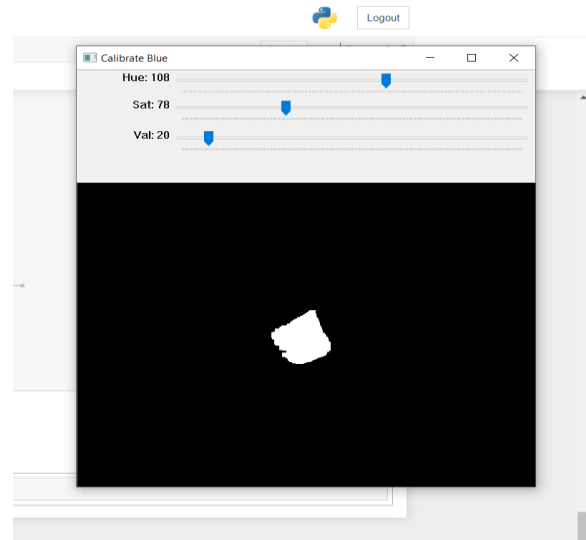
Colour Calibration

Fig.3. Calibrating colours

Based on the inputs given it calibrates the colour. Here it calibrates three different colours yellow, blue and red where we can use coloured finger caps. By changing the hue and saturation we can get the perfect calibration. Space bar is used to see the calibration of next colour and when camera pop ups the command P is used for mouse functions and Command C to view the centroid detection.

Centroid detection becomes a difficult problem in the presence of noise. Readout noise, background noise, photon noise and scintillation effects are dominant effects in atmospheric AO. Due to the presence of noise, mathematically simplest centroiding algorithm like Center of Gravity (CoG) method leads to large wavefront reconstruction errors. To improve upon this technique, Weighted Center of Gravity (WCoG), Iteratively Weighted Center of Gravity (IWCoG), Intensity Weighted Centroiding (IWC), correlation based centroiding, matched filtering based centroiding were developed. In this paper, we studied the performance of CoG, WCoG, IWCoG and IWC techniques. The centroid, (xc, yc) can be computed in the case of CoG using the formula.

$$(x_c, y_c) = \frac{\sum_{ij} X_{ij} I_{ij}}{\sum_{ij} I_{ij}}$$

where Iij is a two dimensional image function with M×M pixels, i and j take values 1,2,….M. In the case of WCoG, a weighting function (generally Gaussian) is used to take the advantage of the shape of the spot.

$$(x_c, y_c) = \frac{\sum_{ij} X_{ij} I_{ij} W_{ij}}{\sum_{ij} I_{ij} W_{ij}}$$

$$W(x, y) = \frac{1}{2\pi\sigma^2} \exp\left\{-\frac{(x - x_c)^2}{2\sigma^2} - \frac{(y - y_c)^2}{2\sigma^2}\right\}$$

where, σ is the spread of the spot.In IWC, the weighting function is defined as powers of intensity, $W(x, y) = \{I(x, y)\}p$, p is real and positive. CoG performs best in high Signal to Noise Ratio (SNR) conditions. WCoG is generally used in the closed loop AO where the shift in the spot is small. This technique shows a significant improvement over CoG in the presence of readout and background noise. IWCoG can be used effectively in closed as well as open loop AO systems but this technique is time consuming and has problems in iterative convergence. IWC performs best in photon noise limited conditions. The phase values are related to the measured slopes through a linear system of equations, Ax=b, where 'A' is the coefficient matrix, 'x' is a vector containing phase values to be calculated and 'b' represents the measured slope values. The coefficient matrix is a sparse matrix in AO case and hence sparse matrix methods are generally used for wavefront reconstruction from slope values.

VI. NOISE REMOVAL & DEFINING FUNCTIONS IN VIDEO FEED

Only the three fingertip colors are extracted from the video one by one depending on the calibration done by the user using the cv2.inRange() function. Noise removal from the video feed can be done by two – step morphism Erosion and Dilation. The filtered image after removing the noise is known as mask which is sent to the program for locating the centers of the three colored fingertips. The three centers of the colored fingertip location involves finding contours in the mask with respect to that color range, Discard contours of unwanted areas using area filters, Finding the largest contour amongst the remaining ones and applying the method of moments to find its center. Then comes the step for defining the position of the cursor on the screen. The thumb, with yellow color, is responsible for the position of the cursor. The following techniques have been used in this end.

Generally, the webcams we use captures video at a resolution of 640×480 pixels. Suppose this frame was linearly mapped to the 1920×1080-pixel display screen. If the user is right-handed, it would be difficult for him to access the left corner and bottom portion of the screen. Instead of mapping the whole video frame to the screen, a rectangular sub-portion measuring 780x270 pixels is mapped to the screen with 4 as the scaling factor. It will be more biased towards the right considering a right-handed user and upper parts of the frame in order to improve comfort. The centers keep vibrating around a mean position due to vibrations of the hand and noise captured by the web camera. On scaling up, these vibrations create a lot of problem with the accuracy of the cursor position. Differential position allocation is used to reduce the shakiness of the cursor. New center is compared with the previous position of the cursor. If a difference is less than 5 pixels, it is usually due to noise. Thus, the position of the new cursor is inclined more towards the previous one. The other drawback is the color oscillations, the background shouldn't have the three colors which we use as input for hand gestures.
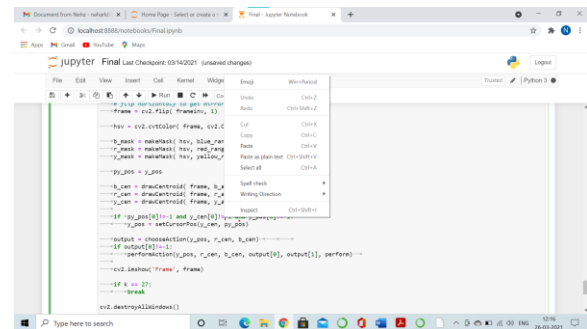
VII.RESULTS AND DISCUSSION

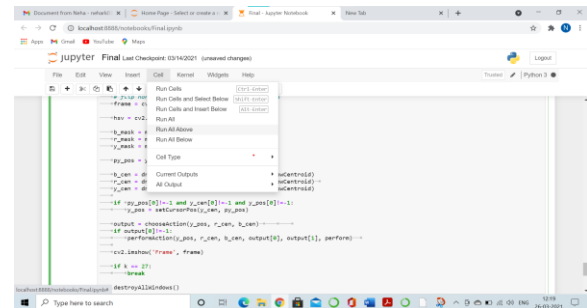RIGHT CLICK

Fig.4. Mouse function (Right click)

LEFT CLICK

Fig.5. Mouse function (Left click)

TEST CASE

Input	Expected Output	Actual Output	Comments
Start the tool	Starting off the camera fragment	Camera fragment gets started	Pass
Color Calibration	The camera recognizes the colors and it can be calibrated	Colors Blue, Red, Yellow are Calibrated	Pass
Capture image	Capture the image	Capture the image	Pass
Process image	Processing of the image	Processing of the image	Pass
Check Center	Verify the centers of the three colors	Centers of all the three colors detected	Pass
Execute gesture	Execute the respective gesture	Execute the required gesture	Pass

Using the hand gesture that is the video that is capturing used the position of the hand is captured by the computer.

The result is that an efficient program has been created that would act as a source of input device and this would be highly reliable. This would serve as a solution for the problems caused by today's input devices like the mouse and keyboard, that is they tend to be less interactive, and they require physical contact. This would bring about a revolution in the present day's input devices.

VII.CONCLUSION

This paper is proposing a system to recognize the hand gesture and replace the mouse. That includes the movement of the mouse cursor, the drag right clicks, left click, scroll up and down. The execution of the gestures to attain an interactive motion is achieved by the help of this project. Hence this is a solution to the present-day input devices that are less interactive and highly tedious to work on for a large amount of time continuously. This can be used efficiently in many sectors.

VIII.FUTURE ENHANCEMENTS

The system works well for the simple pointing and pinching gestures, there is still room for many improvements. Currently the system uses a static background, but it would be very desirable and important to use this hand tracking system in a world of augmented reality setting it in a way where a user, wearing a head-mount display, could interact with virtual 3D objects in the real-world. For this scenario, more than one layer of capturing ability is needed, that is need multidimensional camera angel capturing the hand gestures. There will be requiring of 3-axis that is cameras on 3-axis, X axis, Y axis, Z axis. On the basis of the camera recordings the 3-D image will be captured or recorded, and the defects count will get more accurate and it will be easier for the computer to read the image and defecate the defects.

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