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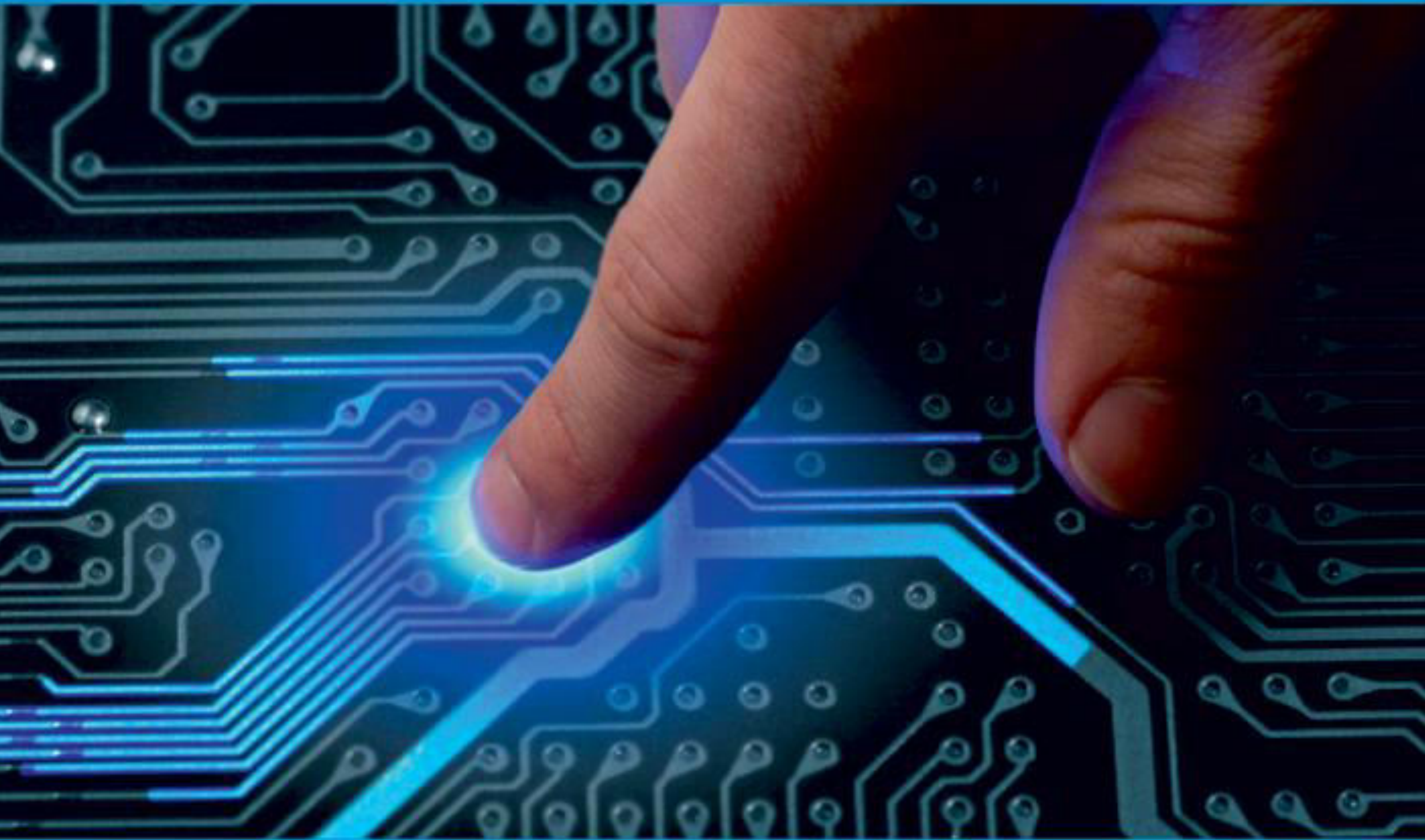

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Detecting Hand Gesture to Control Computer Application

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ABSTRACT: Mankind has grown from Keyboard input to touch. Now the big question is, What Next? This study proposes a solution to problem by presenting a novel technique to reduce the difficulty of operating the most often used group of computer programmes.. Hand gestures can be used to control a variety of apps using the proposed technique. A user can designate a hand gesture to his or her preferred programme and operate it just by posing the gesture in front of the computer. The suggested approach is invariant to the user's skin tone as well as the lighting condition in the backdrop because it relies solely on the peaks formed by lifted fingers. The task can be completed with a simple web cam that works at 30 frames per second and has a resolution of up to 30 mega pixels.The images are captured through web cam. Pre-processing is also done to remove background noise and segment the hand item from the background. Similarly, only the segmented hand object is recovered and processed for the computation of shape-based characteristics. This paper works along the same lines as the speed dial application on smart phones, which reduces the time and effort required to open contact details.

KEYWORDS: Controlling Applications, Centroid, K Curvature, Computer Vision, Image Processing, Hand Gesture Recognition, Human Computer Interaction.

I. INTRODUCTION

Motivation:

Computer applications are controlled using a keyboard, mouse, joystick, and other devices, and are currently operated using a touch screen.. The next natural step in making control easier is to use hand gestures. Gestures are movements of the body, face, or hand, or any physical action taken by the user to express information to another person.. Gesture recognition is the method by which a user's gesture is recognised by the system using computer vision and a webcam attached to the computer. Hand gestures are increasingly being used as a replacement for new input modes in a variety of applications. Hand gestures have the natural capacity to communicate ideas and activities extremely readily; hence, employing these diverse hand forms, which are identified by gesture recognition systems and interpreted to generate matching events, has the potential to provide a more natural interface to the computer system. Immersive virtual environments rely on this type of natural connection. It is simple to recognise that we use a variety of gestures in our regular personal conversation.. People gesticulate more when talking on their phones because they can't see each other like they can when talking face to face. We actually gesticulate twice as often as we speak. Gestures vary considerably throughout cultures and are still used extensively in communication. The widespread usage of gestures as a means of interaction in our daily lives stimulates the development of gestural interfaces and their use in a wide range of computer vision applications.

Related Work: For tracking and identifying various hand motions, multiple gesture recognition systems have been created. Each has its own set of advantages and disadvantages.. The first is wired technology, which requires individuals to connect or interface with the computer system by tying themselves up with wire.. Users of wired technologies are unable to move freely since they are wired to the computer system. The problem was the wire's length..Like a telephone it does not give us the freedom and therefore have limited movement. Then there are data gloves, electronics gloves, and instrumented gloves. These instrumented gloves have sensors that offer information such as hand location, finger position, and so on. The benefit of employing sensors is that they practically never fail.. These data gloves provide good results but they are extremely expensive to utilize in wide range of common application. Data gloves are then replaced by optical markers.

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II. THE PROPOSED ALGORITHM

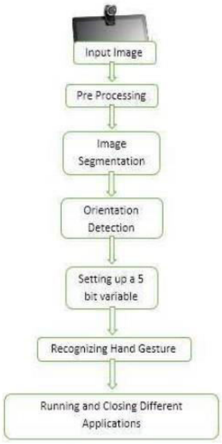

Figure 1

Noise Removal We fill holes in the image by a Xk = (Xk-1 B) Ac B is the symmetric structuring then contains all the filled holes; the un filled holes. After removing noise it us that cope with some drawbacks of classi I sture Recognition cessary for image enhancement. Our cameras take im converted in to YCbCr images as RGB color space is m color space; rather, it is a way of encoding RGB i B primaries used to display the signal. Therefore a imary chromaticity is used. Cathode ray tube displays signals are not efficient as a representation for storage is the number of bits used to transmit a message minu mount of wasted space used to transmit certain data [2]. nent and CB and CR are Chroma components. Here, the and B′ nominally range from 0 to 1, with 0 represe hite). The following figure shows RGB and YCbCr ima Figure 2: RGB and YCbCr Images a structuring element B ing element.

Pre-processing

Image Pre-processing is necessary for image enhancement. Our cameras take images in RGB format Because RGB colour space is more sensitive to varied light conditions, this technique converts RGB photos to YCbCr images. The YCbCr colour space is not an absolute colour system.; rather, it is a way of encoding RGB information. The actual color displayed depends on the actual RGB primaries used to display the signal. As a result, a YCbCr value is only predictable when normal RGB primary chromaticity is utilised.. Red, green, and blue voltage signals operate cathode ray tube displays, but these RGB signals are inefficient as a representation for storage and transmission due to their high redundancy. The number of bits utilised to send a message less the number of bits of real information in the message is known as redundancy. It's the amount of wasted space used to send specific info.

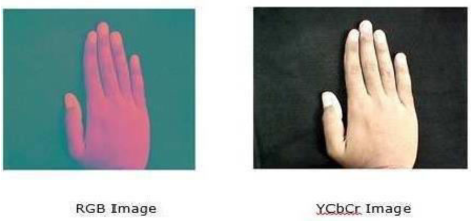

Figure 2: RGB and YCbCr Images

Noise Removal:

A structuring element B fills in the gaps in the image.

$X_k = (X_{k-1} \oplus B) \cap A^c$

B is the symmetric structuring element If Xk= Xk-1, the algorithm ends at iteration step k. The filled holes

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are contained in the set Xk; the filled holes are contained in the union of Xk and A; and the filled holes are contained in their borders. It employs a fuzzy filter after reducing noise. Fuzzy filters show promise in image processing jobs, overcoming someof the limitations of traditional filters. The fuzzy filter can handle information that is both ambiguous and uncertain.

Figure 3: Noise Removal

Then convert the noiseless image to binary image. Each pixel in a binary image is represented as a single bit 0 or 1..Fig 3shows the binary images

Figure 4: Binary Image

Dilation and Erosion:

In an image, dilation adds pixels to object boundaries, whereas erosion removes pixels from object boundaries. The size and shape of the structuring element used to process the image determines the number of pixels added or removed from the objects in the image.. The state of any given pixel in the output image is defined by applying a rule to the relevant pixel and its neighbours in the input image in the morphological dilation and erosion operations.

Figure 5: Image after Performing Dilation and Erosion

Segmentation: To locate the hand in the image, look for boundary edges.We localize the hand in the image. Scanningthe translated binary image from left to right, right to left, and top to bottom accomplishes this.. The first white pixel (or 1) on the left gives us the leftmost boundary of the hand, The rightmost boundary of the hand is defined by the first white pixel on the right, and the highest boundary of the hand is defined by the first white pixel from the top of the image.We do not repeat the same process for the bottommost white pixel as it will always give the hand [1].Orientation Detection: The coordinates of the various borders of the localised hand object are calculated.. In the binary matrix (ofthe localized binary image) we calculate the number of rows as well as the number of columns.

Orientation Detection: The coordinates of the various borders of the localised hand object are calculated.. In the binary matrix (of the localized binary image) we calculate the number of rows as well as the number of columns. (row2-row1) gives us the number of rows. The binary matrix's last row is row2, while the first row is row1.Similarly (column2-column1) gives us the number of columns.

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Peaks Detection: Peaks are found by finding the tips of the fingers to find the number of fingers raised. The pre-processing section obtains the segmented binary image's boundary matrices.This part is performed over the hand except the thumb region that is the binary hand image is localized such that the part under consideration is only the part except the thumb region. Here it calculates the local maximas and the local minimas.

minimas in both the cases. We take the average of all the local minima's of y coordinates for a vertically rising hand.

$$m = average\ minima = \frac{sum\ of\ local\ minimas\ of\ y\ coordinates}{total\ number\ of\ local\ minimas}$$

where m is the reference point's y coordinate and R is the midpoint of the localised hand's x coordinate, giving us (m,n) as the reference point. R if the hand object is vertically raised.

$$n = \frac{x\ coordinate\ of\ last\ white\ pixel - x\ coordinate\ of\ the\ first\ white\ pixel}{2}$$

If the hand item is elevated vertically, (m, n) provides us the reference point R. The average of the local minimas of x coordinates is taken for a horizontally raised hand.

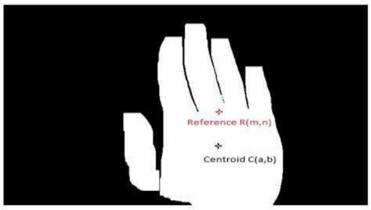

Figure 8: Reference Point

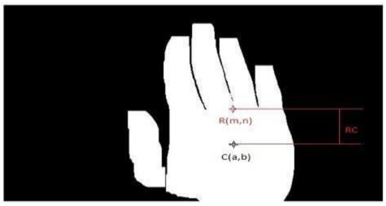

Figure 9: Length RC

Also the Euclidean distance between Centroid C (a, b) and each local maximas is calculated, that is, every peak.Say Q (x,y) is a local maxima then,

$$Length\ QC = \sqrt{(x-a)^2 + (y-b)^2}$$

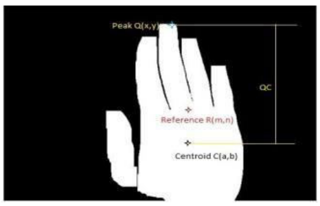

Figure 10: Length QC

Setting Up a Variable:

We create a variable called z that accepts a 5 bit binary value. We have 25 distinct motions for 5 fingers, 12 ofwhich are allocated to launch user-assigned applications, 12 to close these opened applications, and 00000 to kill all running applications. This procedure is finished using 11111 running different applications with different hand gestures.

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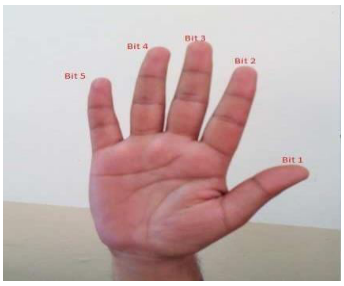

Figure 13: Bit Defined for Different Fingers

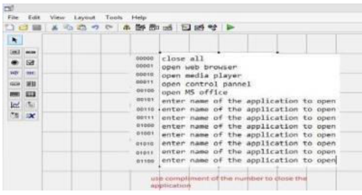

Figure 14: GUI to Assign Different Applications to Different 5 Bit Values

III. RESULT AND DISCUSSION

The system was put to the test in real time, and the results were quite encouraging. We put our system through its paces ten times with different people.

Five Bit Value	Recognition Rate (%)
00000	93
00001	91
00010	89
00011	91
00100	92
00101	88
00110	90
00111	91
01000	91
01001	91
01010	92
01011	89

Table 1: Contd.,	
01100	91
01101	92
01110	89
01111	90
10000	91
10001	92
10010	91

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10011	90
10100	91
10101	92
10110	93
10111	92
11000	91
11001	95
11010	96
11011	92
11100	94
11101	90
11110	89
11111	95

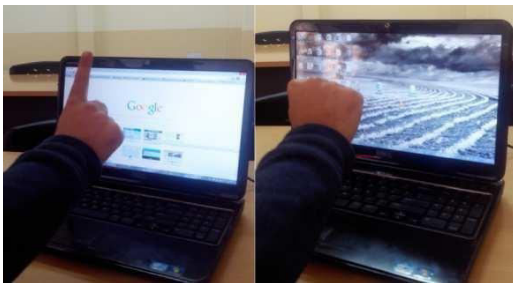

Figure 15: Running Applications

IV. CONCLUSION

We suggested a shape-based approach to hand gesture recognition that allows us to launch numerous applications with a single hand movement. This work pre-processed the image before determining the centroid and reference point. The lengths between the reference point, centroid, and peaks are determined; if the length of the peaks is larger than the length of the reference point, it is a peak.Number of peaks detected gives the number of fingers raised and it is checked if the thumb is also raised or not, which is assigned to different applications that can be opened by the user These are user-defined applications. It functions similarly to speed dial on our phones. This can save a lot of time and is ideal for folks who are short on time. By converting the values to binary and assigning them to the variable, we may expand the amount of applications we can access with just these actions. The proposed approach is straightforward and unaffected by user preferences. Work on both hands will be possible in the future.

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