Remotely controlled PowerPoint presentation navigation using hand gestures

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***Abstract*—Presentation using slideshow is an effective and attractive way to convey information in the digital world. There are various means to control slides which require devices like mouse, keyboard, or laser pointer etc. The disadvantage is one must have prior knowledge about the devices in order to operate them. This paper proposes a new method to control the slides during a presentation using bare hand. This method employs hand gestures given by the user as input. The gestures are identified by counting the number of active fingers and then slides are controlled. Unlike the conventional method for hand gesture recognition which makes use of gloves or markers or any other devices, this method does not require any additional devices and makes the user comfortable. The proposed method for gesture recognition does not require any database to identify a particular gesture. It gives better accuracy even in environments illuminated with different light sources like incandescent bulb, fluorescent lamps and natural light**

***Keywords*— hand gestures, skin segmentation, active fingers, finger count.**

I. INTRODUCTION

Vision based gesture recognition techniques are of major interest in the field of research. People can interact with the system in a device-free manner and this property of vision based hand gestures make them user friendly. The hand gestures must be identified in any environment .i.e. under varying illumination conditions. The image or video acquired may be noisy or may reduce the performance by recognizing surrounding as hand region. The acquired data is subjected to segmentation and processed further to make it fit for approximation with the gestures (data) stored in the database.

The other means of detecting hand gestures involves usage of markers or gloves to identify the hand gestures [6], [8]. Some acquire the hand gestures using two cameras to obtain the 3D view of the hand and from the 3D model of the hand, gestures are recognized [7]. But it involves storage of images of hand to compare with the acquired data and makes use of complex algorithm to compare the images and identify the correct gestures.

Controlling the slideshow is a vital task during presentation. The slides must be controlled according to the presenter's need. There are various ways to control the slides but most of them depend on external devices such as mouse, keyboard, laser pointer, etc. [3]. As described above the user may carry the device or may wear some bands or markers or gloves to control the slides with hand gesture. Some of these gloves are connected to the computer to detect the movement of hand which makes gesture recognition a complex task [6].

This paper suggests a technique to control the slides of power point presentation in a device free manner without any markers or gloves. Using bare hand the gesture is given as input to the webcam connected to the computer. Then using an algorithm which computes the number of active fingers, the gesture is recognized and the slideshow is controlled. The proposed method involves segmentation of the hand region from the acquired data. Then the centroid of the segmented hand is calculated following which the number of active fingers is found. Then the gesture is recognized. This does not involve storage of data. So controlling the slideshow during a presentation becomes user friendly.

II. ARCHITECTURE

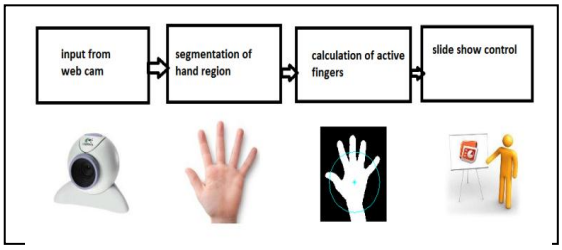

Figure 1. Architecture of the proposed method

A. *Segmentation of hand region*

The user makes the hand gestures by positioning the hand parallel to the webcam. The video is then processed to extract the hand region. The surrounding must be properly illuminated in order to minimise the error and the background should not contain any element that has skin colour.

The resolution of the webcam is kept at 640 x 480 pixels for better quality of video. In real world scenario the background may be made up of different elements. Hence a background

subtraction is performed in order to segment the hand region from other regions.

The video obtained through webcam is in RGB colour model. This video is converted to HSI colour model because the regions which belong to skin can be easily identified in HSI model. Following this, the rules for skin segmentation are applied. The values for hue and saturation must be between 0.4 to 0.6 and 0.1 to 0.9 respectively.

$$0.4<H<0.6 \text{ and } 0.1<S<0.9 \quad (1)$$

The regions with in the range of (1) are detected as skin and applying the above rule results in a binary image. The skin regions are represented using white colour and all other non-skin regions are black. The largest connected region which is detected as skin is taken as the hand region. This gives the segmented hand region and this is the region of interest. The recognition of the gestures depends on this region.

B. Calculation of number of active fingers

The centroid of the segmented binary image of the hand is calculated as follows. A bounding box which encompasses the hand region is drawn. If the hand is oriented in vertical direction then the difference in the y coordinates of the bounding box and the centroid gives the length of the largest active finger. The centroid calculated is made as the centre and the value of radius is the length of the largest finger multiplied by 0.7 [1]. With the centroid as centre and length of the largest finger multiplied with 0.7 as radius, a circle is drawn to intersect with the active fingers of the hand. If a finger is active then it intersects with the circle. A graph is used to count the number of transitions from white to black region. This number gives the number of active fingers. From the number of active fingers the gesture made can be determined. If a value less than 0.7 is used the circle drawn encloses only palm region. If a value greater than 0.7 is used the circle doesn't intersect the thumb.

Since the recognition of gesture depends purely on the number of active fingers any finger can be used to denote a count. Only the count value of the active fingers is taken as input. So the user can feel free to represent a count irrespective of the finger. Hence value one denoted by the user using his index finger or thumb will be the same.

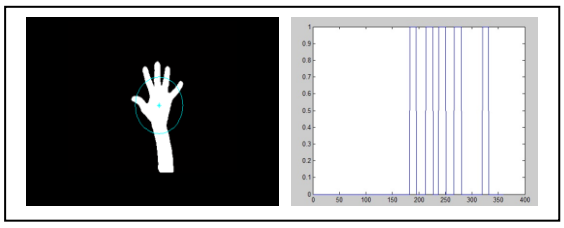

Figure 2. (a) image showing the circle intersecting the active fingers (b) the graph showing the transitions from black to white region

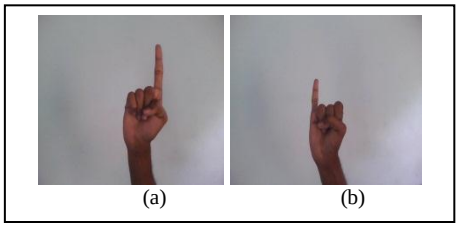

Figure 3. (a) and (b) various gestures to represent number one

III. CONTROLLING THE POWERPOINT USING HAND GESTURES

The count determined by constructing the circle will control the slide show. The count value and the control are:

- Count 0- For transition from one gesture to another
- Count 1- Next slide
- Count 2-Previous slide
- Count 3-Start slide show
- Count 4- Exit slide show

Initially all the fingers are kept closed as shown in Fig. 4(e) and then a gesture for controlling the slides is performed as in sample images in Fig. 4(a) to (d). After a gesture is made all the fingers are closed as shown in Fig. 4(e) and after a time delay of 2 seconds the next gesture next is made.

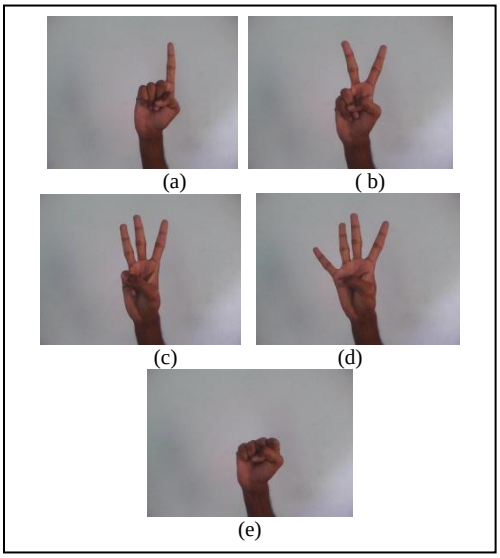

Figure. 4(a) Gesture for next slide (b) previous slide (c) start slide show (d) end slide show (e) transition from one gesture to another

IV. IMPLEMENTATION

The hand gesture is found using the number of active fingers. Each hand gesture is mapped to a particular action as mentioned above. Each action is performed by a particular .Net function. These .Net functions are stored in a dll file and loaded in MATLAB. The functions in the file control the slideshow.

The algorithm was implemented on a system with Intel dual core processor with speed of 2.53 GHz using MATLAB software.

V. EXPERIMENTAL RESULTS

The work was experimented with more than 10 people under various illumination conditions such as fluorescent lamps, incandescent lamps and sunlight. The samples were carefully chosen so as to make sure that there are no elements having colour similar to skin colour in the surroundings. The overall accuracy of the experiment turned out to be more than 90 %.

The percentage of accuracy for the gesture used to move to next slide is around 79%. The decrease in efficiency is due to human nature to misplace the hand from fixed position. The efficiency decreases if the background has elements like wall hanging, drapes, furniture, etc. containing colour similar to skin colour. Problem occurs if the fingers are not stretched properly while making a gesture.

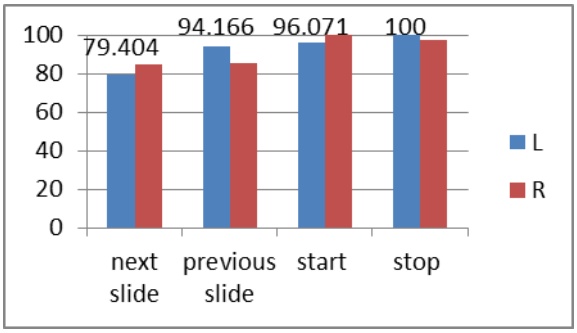

Figure 5. Graph showing performance of the experiment for various hand gestures

VI. CONCLUSION

This method gives unique presentation technique which makes use of gestures using bare hand to control the slide show. Moreover this way of vision based hand gesture recognition does not store any images in database to identify the gestures. The hand gestures are identified based on number of fingers used to make a gesture. So any finger can be used to denote a particular number but this also reduces the number of unique gestures that can be made. If we identify the finger with which a particular gesture is made then each gesture can be unique and those gestures can be used to control real time applications like VLC media player, paint, pdf reader etc.

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