Sixth Sense Technology Based Pointer Interface System

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Abstract: As computers became more common in society, promoting natural human to computer interaction (HCI) will have a positive influence on their use. Hence, there has been growing interest in the development of new approaches and technologies for bridging the human–computer barrier. A Real Time Vision Based Pointer interface system is a new vision-based interface, which is sufficiently fast and effective to substitute a computer mouse. System is able to reduce hardware impact and also increases range of usage of physical word objects instead of digital word objects like mouse. The aim of a system is to bring HCI to a level where interactions with computers will be as natural as an interaction between humans.

Keywords: *HCI.*

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I. INTRODUCTION

Commonly keyboard and mouse are used as a input device to computer. To achieve natural human to computer interaction, the human hand could be used as an interface device. Hand gestures are a powerful tool used to achieve human to human interaction. Hand gestures forms a major part of information transfer in our day-to-day life. Hand gestures are an easy to use and natural way of interaction. For example, sign languages have been used broadly among speech-disabled people. People who can speak also use many kinds of gestures to help their communications [1], [2].

Human to computer interaction (HCI) involves a variety of problems related to designing the communication between humans and machines. First of all, the HCI interfaces are based on hardware devices such as mouse, keyboard and they also require a software components which converts the signal from these input devices to information that controls the machine. Recently, the touch-screens have gained on popularity. In these system interaction between humans and machines is based on an illusion that the user manipulates physical objects on the screen, which provides a noticeable speedup between the user's intentions and machine's action. There are also a number of attempts made to depend completely on the visual information and create a touch-less Human to computer interaction. This would reduce the hardware layer to a simple camera, but it requires advanced computer algorithms for gesture analysis [3].

It has been widely accepted that the computing, communication and display technologies progress further, but the existing techniques may become a barrier in the effective utilization of the available information. To efficiently use the available information, most computer applications require more and more interaction. For that reason, human to computer interaction (HCI) has been a lively field of research in the last few years [3].

Virtual interaction between computer and user without using hardware like mouse makes this entire system user friendlier and simple. This makes the system helpful to the visually impaired persons. Solution is placed between traditional pointing devices and touch-screens in terms of user experience, giving the users an illusion that they are interacting with physical objects [3].

The background of a real time vision based pointer interface system is discussed in section II, Section III describes the design requirement of the system and finally paper is concluded in section IV.

II. LITERATURE REVIEW

The gesture-based HCI development in recent years introduced several interesting interaction interfaces. They are based on two main approaches to the interaction. The first one relies on the hardware and sensors, for example a data glove. Precision and accuracy is a big advantage of this equipment. It measures directly the hand position, its orientation, fingers directions and angles. However, its price is very high and out of range for an ordinary computer user. Moreover, the equipment reduces the comfort and naturalness of the interaction due to the hardware that must be worn [4].

The second approach is based on the computer vision techniques. This does not require any special hardware for the interaction, hence such solutions are potentially available to all computer users. Such an interface is contact-free, so the naturalness and comfort can be preserved. The weakest point of such systems is their high dependence on the environment conditions (mainly lighting) [5], [6].

An interesting vision-based interaction concept was presented by Wilson and Cutrell. Here, the hand movements are captured using optical flow to control the mouse cursor position, but for other operations (e.g. clicking) the conventional hardware must be used. In addition, the authors outline how to extract basic hand features like size or tilt, but the hand shape or trajectory is not taken into account. The vision-based systems involve several image processing stages, i.e. skin region segmentation and hand detection, hand feature extraction and pose estimation, and finally, hand landmarks tracking and trajectory analysis [7].

In general, among the skin color models, statistical and parametric solutions can be distinguished. The parametric skin models are based on fixed decision rules defined in color spaces after analysis of skin-tone distribution. These rules are applied to determine if a pixel color value belongs to the skin [8].

Statistical skin color modeling is based on analysis of skin pixel values, distribution for a training set of images, in which skin and non-skin areas are already identified and annotated. This creates a global skin color model which makes it possible to determine the probability that a given pixel value belongs to the skin class. The main difficulty of skin region segmentation lies in high dependency of the skin models from the lighting conditions [9], [10].

There are many approaches to extracting hand features, based on which the recognition can be performed. Tan and Wu described hand state by image moments [11]. Boreki and Zimmer employed contour and its curvature analysis [12], while Manresa et al. used contour and convex hull [13]. Both methods allow for extracting information on the actual hand shape (e.g. convexity defects which can be used for finger detection). MacLean employed skeletonization concept for hand recognition, especially for finger detection [14].

Bhuyan et al. presented a different approach, where a vector of certain features (values), is extracted from the gesture trajectory. This vector forms a mathematical description that represents a certain class of gestures. A set formed from such vectors defines a knowledge-base that isused for gesture matching [15].

III. DESIGN REQUIREMENTS

In the present world, the interaction with the computing devices has advanced to such an extent that as humans it has become necessity and we cannot live without it. The technology has become so important into our daily lives that we use it to work, shop, communicate and even entertain our self. Now-a-days, mouse is the most popular input device, used for human to computer interaction to interact with the digital world through user's hand.

It would be more comfortable and effective if the user could point directly to the display device without any hardware equipment. Gesture is one of the most natural and expressive ways of communications between human and computer in virtual reality system. With the emergence of new applications like virtual reality system in image processing and machine vision, it is necessary to have more perfect interfaces than mouse and keyboard for Human Computer Interaction (HCI). To cope with this problem, varieties of tools have been presented to interact with computers. Hand gesture recognition is one of the proper methods for this purpose. Hand gesture is one of the important methods of non-verbal communication for human beings for its freedom in movement and so much more expressive may than any other body parts.

The proposed system bridges the gap between the physical world and digital world. The key of this system is to make Human to machine interface simple and easily interactive .Virtual interaction between laptop and user without using hardware like mouse makes this entire system user friendlier and simpler. Adding sound response to the system makes this system helpful to the visually impaired persons. Clearly, it has the potential of becoming the ultimate "transparent" user interface for accessing information about everything around us.

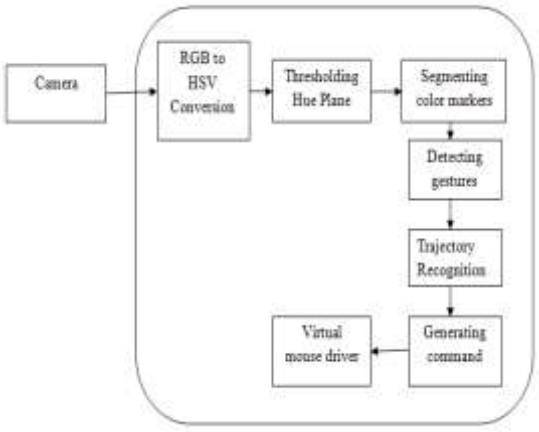

Figure 1: A Real Time Vision Based Pointer Interface System

The block diagram of the proposed real time vision pointer interface system is shown in Figure 1. The interaction with the physical world is done by camera. Camera is used as a sensor. Camera is attached to laptop by using USB. Here, USB webcam with 640 by 480 resolution used as a source of input. Camera takes the video and starts recording the live video and in continuation of recording it sends the live video to MATLAB which is installed in laptop. MATLAB contains software routines of camera initialization, rgb2hsv conversion, morphological operations, and centroid locating, virtual mouse driver and projector interface. In MATLAB, code is prepared which convert the incoming live video from camera into frames of images or slicing of video is done in the form of images.

These images that are obtained from the slicing of video are then flipped and processed for color recognition process. The outputs of the color recognition process are the images that contains only those colors of which color caps are present at the fingertips of the user. Neither the fingers of user are shown in the output images nor any background colors, there in the output images from the color recognition process.

For this purpose, RGB values of the color caps are set prior in the code so that no other color will be detected in the image after color recognition except the caps colors. The output images are displayed in continuation and at the same speed as the speed at which slicing of video is done, so that it looks like a continuous movie in which the input is physical world and the output is only those colors which are present at the fingertips of the user. Depending upon gesture, command will be picked up from look up table and will be fed to virtual mouse driver. Virtual mouse driver will execute the command and will move the cursor physically.

IV. CONCLUSION

The real time vision based pointer interface system presents a new solution for human to computer interaction that uses hand gestures for natural operation without any devices restraining the hand freedom. This can greatly increase the usability of such interfaces and not only going to reduce the hardware impact of the system but also it increases the range of usage of physical world object instead of digital object like mouse.

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