HUMAN COMPUTER INTERFACE USING IMAGE PROCESSING

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Abstract- **Human Computer Interaction (HCI) is concerned with the design, evaluation and implementation of interactive computing system for human use The development of user interface influences the changes in the Human Computer Interaction. Hand gesture communication is a non verbal interaction which is widely used to interaction of the user with the computer system. Hand gesture communication uses our hands to move objects around for more complex expressions for the feelings and also used for communicating with others. Human computer interaction is special technique of removing complex commands and bulky interaction devices and replace them to more easy and expressive meaning of interaction like hand gesture which is easily interact with the users. In this paper, we mainly use gesture recognition system, image processing and contour analysis technologies for the interaction between the user and computer. The aim of our project is to interact with the computer machine by using human hand gestures instead of using mouse of the device.**

Keywords – Human computer interaction, Hand gesture recognition, Image processing, dynamic interface

1. INTRODUCTION

With the development of information technology in our society, we can expect that computer systems to a larger extent will be embedded into our environment. These environments will impose needs for new types of human computer-interaction, with interfaces that are natural and easy to use. The user interface of the personal computer has evolved from a text-based command line to a graphical interface with keyboard and mouse inputs. However, they are inconvenient and unnatural. The use of hand gestures provides an attractive alternative to these cumbersome interface devices for human-computer interaction (HCI). User's generally use hand gestures for expression of their feelings and notifications of their thoughts. In particular, visual interpretation of hand gestures can help in achieving the ease and naturalness desired for HCI. Vision has the potential of carrying a wealth of information in a nonintrusive manner and at a low cost, therefore it constitutes a very attractive sensing modality for developing hand gestures recognition. Recent researches [1, 2] in computer vision have established the importance of gesture recognition systems for the purpose of human-computer interaction. Human-Computer Interaction is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings. The user interface is hardly

designed with the ability performance in desired education system. Now a day, Human-Computer Interaction is a research area. The human computer interaction devices such as keyboards, mouse, and touch screens are deficient for latest essential environment. These keyboard, mouse etc, restricts the sensitivity and the complete utilization of high performance in the required applications.

In human computer interaction, hand gestures are the most natural and easy way of communication. Human hand gestures has the powerful and instinct property of communications and makes it them sufficient as HCI devices. The primary goal of gesture recognition research is to create a system which can identify specific human gestures and use them to convey information or for device control Gesture recognition has been studied in widely topics, and has a wide range of applications such as recognizing of sign language, human computer interaction (HCI), In the present work, the complex commands of the computers are controlled by easier hand gestures and provide the easy communication between user and computer device for example, we can browse the image in an image browser or controlling the power point presentation with the help of hand gestures without any physical contact with the device or various commands. The user may benefits from such means of interaction in communicating with computing devices used in dynamic environment.

Human computer interaction is an inexpensive and easier in use, versatile and fast. They are mostly used by highly trained professionals to train and accomplish their operations in the effective environment. Gesture recognition systems are divided into three stages namely image pre-processing followed by tracking and finally by the recognition stage. Gesture recognition system is a vision-based approach that acts like an interface between the user and computing device in a

dynamic environment. The usage of a natural device free interface is the primary goal of this proposed system that recognizes the hand gestures as commands. For the interaction of user with the computing device, this system uses a low cost webcam which is used for image acquisition. This interaction performs different applications like browsing image in the image browser, controlling power point presentation writing words on the notepad etc. by some predefined hand gestures that acts as an interaction instructions or commands.

2. RELATED WORK

Gestures are powerful means of communication among humans. Among different modality of body, hand gesture is the most simple and natural way of communication mode. Real time, vision based hand gesture recognition is more feasible due to the latest advances in the field of computer vision, image processing and pattern recognition but it has yet, to be fully explored for Human Computer Interaction (HCI) [11]. A Typical Hand Gesture Recognition system consists of mainly four modules: Gesture acquisition, Tracking and segmentation, Feature extraction and description, Classification and recognition. In any typical hand gesture recognition system, a good and strong set of features, description and representation are required. In the current state of the art, due to the limitation of data glove/sensor based approaches, vision based (appearance based) and 3-D hand model based approaches are being used [20]. One of the major tasks in hand gesture recognition is the description of the gesture. Various methodologies are found in the literature such as, statistical and synthetic based approaches. In statistical representation, one can represent it, in the form of feature vector and then apply classification and recognition algorithm; whereas synthetic gesture recognition gesture can be represented in the form

of tree, string or graph and decision rule such as graph matching, decision tree and string matching. Now days in the field of Human Computer Interaction, Hand Gesture recognition [HGR] is an active research topic. In this section, various approaches and techniques have been explored related to hand gesture recognition Recognizing gesture is a complex task which involves many aspects such as object detection, object description, motion modelling, motion analysis, pattern recognition and machine learning even psycholinguistic studies also required [2].
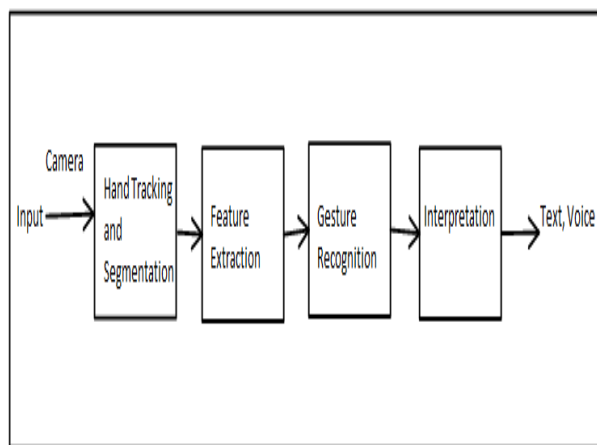

Fig.2.1. Block diagram of Hand Gesture
Recognition System

Figure shows typical block diagram of HGR system. Hand tracking and segmentation are to be done on captured video and feature extraction is to be done on segmented hand image which is further given to classification and recognition phase. Output is to be printed or executed, depending on the application. In this paper, survey has been carried out on various methods adopted by various researchers on defined steps

a.Hand Tracking and Segmentation:-

 After capturing and separating frames from videos, the elementary and important task is detection and segmentation of hands. There are various approaches and techniques available in literature [18] but the results vary, images to images due to the limitation of vision based approach such as variable lightning condition, variation of skin colour, detection of hand in complex background. Pixel and region based segmentation techniques are available [10,11]. In India, there is deviation in human skin colour tones. So, finding out adaptive colour model is a big challenge for skin colour detection [11]. It has been observed that HSV and YCbCr colour model gave better result for skin colour detection [12] than other models due to the separation property of luminance and chrominance component. Some researcher used additional marker or colour gloves for hand segmentation using colour thresholding , but for natural interface bare hand interaction is always preferred. Supervised as well as Unsupervised Learning Model such as Bayesian classifier can be used for skin colour segmentation [4]. Unsupervised learning such as, K-mean clustering is also a good option for skin colour segmentation. 2D Tracking algorithm gives the position information of hand such as colour tracking, motion tracking, template matching, blob tracking, Multiple cues integrating methods are available. It has been noticed that tracking algorithm such as mean shift, camshaft [, viola Jones with appropriate colour space gave better segmentation result in complex background.

b. Feature Extraction:-

After studying hand skeleton model it has been noticed that shape is the important visual feature of the hand. Zhang and Lu [5] gave classification of shape representation and description techniques based on contour and region. In contour based method, shape features are extracted from the shape boundary whereas, in region based method features are extracted from the whole shape.In hand recognition problem, shape contour is important

than whole region so, contour based methods are mostly used. But for complex sign, sometimes region based methods are more suitable because it contains all the available information [23]. In case of the new signer for performing gesture, there may be chances for angle deviation, shifting of signer space (translation) can occur. Hand size (scaling) of the signer can also vary. So, while choosing feature extraction method, care must be taken that it should be invariant to translation, rotation and scale. SLs contain large set of vocabulary, use of one of the feature extraction techniques is not sufficient. Practically combination of feature vector and motion vector is the better choice to get accuracy

c. Classification and Recognition :-

An efficient classifier and recognition method plays very important role in any gesture recognition system. This step goes forward with the pattern recognition and machine learning field. The Vision-based hand gesture recognition system also needs to meet the requirements including real-time performances, accuracy and robustness, so use of correct classifier is the need of the any machine learning system. Training and testing the system is the very important aspect of any research work. There are many error estimation methods available such as redistribution methods, Holdout method, Leave-one Out method, Rotation method, n-fold cross validation and bootstrap method. Depending on the availability of sample data and required performance one can choose the error estimation method for analysis of results. Some researcher worked on hybrid classifier or cascaded classifier to get best performance .

Hand gestures are an important modality for human computer interaction (HCI) that compared to many existing interfaces, hand gestures have the advantages of being easy to use, natural, and intuitive. Successful applications of hand gesture recognition include computer games control, human-robot interaction and sign language recognition, to name a few. Vision based recognition systems can give computers the capability of understanding and responding to hand gestures. Alon *et al*. [8] introduced unified framework for gesture recognition and spatiotemporal gesture segmentation applied to American Sign Language (ASL). To recognize manual gestures in video, it is required to do both spatial and temporal gesture segmentations. Spatial gesture segmentation is the problem of determining where the gesturing hand is located in each video frame. Temporal gesture segmentation is the problem of determining when gesture starts and ends.The primary step toward any hand gesture recognition (HGR) is hand tracking and segmentation. In the present work, three techniques for hand segmentation were explored. The objective of this work is to overcome the vision-based challenges, such as dynamic background removal, skin colour detection for natural human computer interface and variable lighting condition.

3. PROPOSED SYSTEM

The proposed system is designed by using the image processing techniques implemented in C++ with the use of OpenCV library. For the processing of the gesture recognition system, some hardware requirements are used, that includes computer or laptop and webcam. Gesture based interface allows human computer interface to be in a natural manner. It makes the interaction device free which makes it useful for dynamic environment. The most important advantage of the usage of hand gesture is that it acts as a input to interact with computing device without any physical interaction with the keyboard or mouse. This proposed research work could be very efficiently used in various

applications where the human computer interaction is the regular requirement. Also the gesture vocabulary designed for controlling different applications. The vocabulary designed also gives flexibility to define gesture based on the user interest foe specific command which make the gesture recognition system more user friendly.

4. SYSTEM ARCHITECTURE

The gesture recognition system based on vision-based approach, which is more suitable for this system. The recognition system acts like an interface between the user and computing device in a dynamic environment. This proposed system uses a natural device free interface that recognizes the hand gestures as commands. This system also uses a low cost webcam which is used for image acquisition. A gestures recognitions system divided into three stages namely image pre-processing, tracking and recognition stage as shown in below figure

Hand Tracking and Segmentation:-

In this approach hand detection and segmentation were attempted. Hand tracking was done by using mean shift algorithms. The hand gesture recognition system recognizes static and dynamic hand gestures. For designing a dynamic user interface, the flowchart of the technique is used. In this system, firstly the image of hand is captured from camera and it processed through the algorithms. The procedure starts by acquisition phase. The background subtraction is performed in the HSV color space and converts each frame into two level gray scale image by removing static background. The next step is segmenting the hands from the background. The next step is segmenting the hands from the background. The HSV color model is used for this purpose .For hand tracking

from the captured image, we have chosen the general Camshift algorithm with shifting the region of interest with average shift in the object of interest i.e. hands. Camshift is based on colors, thus it requires the color histogram for tracking the desired object.
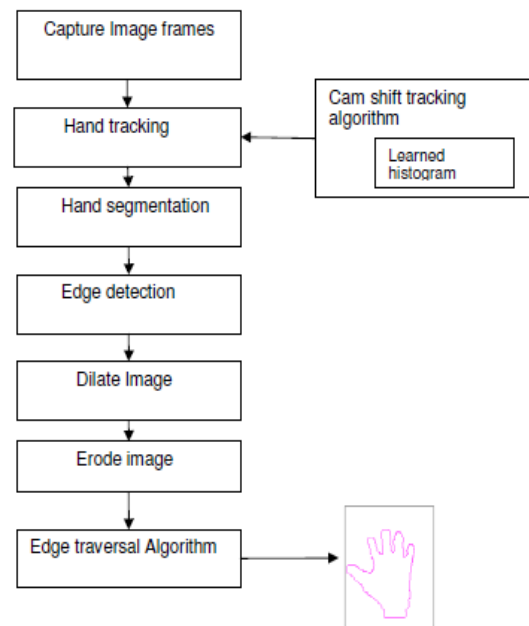

Fig.4.2. Hand Tracking and Segmentation

. In feature extraction several general purpose features are extracted and the relationship between the features and classes are inferred by the appropriate classifier.After extracting features of the input character, the extracted features are classified into different classes then in interpretation stage, each class is mapped to a particular feature i.e. we search its feature in the database and then execution process is done by generating the actions related to the gestures and consider the most similar feature as the result

5. CONCLUSION AND FUTURE WORK

In this system, hand gestures allow a user to use hand as a mouse to control various applications on a computer. To improve the interaction in dynamic environment, it is desired that the interaction should be as easy and natural as possible. Human hand gestures may be defined as a vocabulary generated by the actions of hands. In human computer interaction, hand gestures acts as a input devices in the interaction between user and computer. This is useful for removing the technological barriers while we use hand gestures as a input. Thus the interaction is done by hand gestures without using any contact sensors or physical contact with the device. The problem is that the applications need to rely on external devices that are able to capture the gestures and convert them into input. For this we can use a video camera that grabs the user's gestures also we require processing system that captures the useful features into the appropriate classes. In gesture recognition system there are various applications which requires set of gestures commands, camera for capturing images and restricted background. This interaction performs different applications like browsing image in the image browser, controlling power point presentation writing words on the notepad etc. by some predefined hand gestures that acts as an interaction instructions or commands.

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