The Computer Assistance Hand Gesture Recognition system For Physically Impairment Peoples

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ABSTRACT

In today's technological era, many technologies are evolving day by day. One such promising concept is Human- Machine Interface. For example, in a wired mouse there is no provision to extend limit. In wireless mouse, one should have Bluetooth hardware installed in the computer and Bluetooth dongle attached. The proposed technology will have no such limitations and will instead depend on gesture recognition. In this project, three technologies are mainly used: object detection, image processing and color recognition using „Sixth sense technology". Sixth sense technology is a set of wearable devices that acts as a gestural interface between the physical and digital world. The aim is to move the mouse cursor on the screen without using hardware such as a mouse and only by moving the cursor through finger movements i.e. the process of gesture recognition. In this paper, we present a novel approach for Human Computer Interaction (HCI) where cursor movement is controlled using a real-time camera.

I. Introduction

In this project, the hand movement of a user is mapped into mouse inputs. A web camera is set to take the live video continuously and then from this video various images are being captured by using MATLAB. The user must have a particular color marker or pointer in his hand so that when the web camera takes an image it must be visible in it. This color is detected from the image pixel in MATLAB and object detection is used to map pixel position into mouse input. Taking into account the size of image and resolution, scaling techniques need to be used like image processing or segmentation. Sixth sense technology can be further developed to include multimedia services like videos or saving images using hand gestures. This work aims to provide usual mouse operations using a camera based on colour detection technique. The user wears coloured gloves, the information from which is processed by the system. Individual frames of the video are separately processed. The processing techniques involve an image subtraction algorithm in MATLAB to detect colours. Once the colours are detected the system performs various operations to track the cursor and performs control actions which are explained in further sections. No additional hardware is required by the system other than the standard webcam which is provided in every laptop or computer. Gestures are expressive, meaningful body motions involving physical movements of the fingers, hands, arms,
head, face, or body.

II Literature survey

Hand and Arm gestures: recognition of hand poses, sign languages, and entertainment applications (allowing children to play and interact in virtual environments).Head and Face gestures: some examples are: nodding or shaking of head, direction of eye gaze, raising the eyebrows, opening the mouth to speak, winking, flaring the nostrils and looks of surprise, happiness, disgust, fear, anger, sadness, contempt, etc.;Body gestures: involvement of full body motion, as in tracking movements of two people interacting outdoors, analyzing movements of a dancer for generating matching music and graphics and recognizing human gaits for medical rehabilitation and athletic training.

Sign Language is the means of communication among the deaf and mute community. Sign Language emerges and evolves naturally within hearing impaired community. Sign Language communication involves manual and non-manual signals where manual signs involve fingers, hands, arms and non-manual signs involve face, head, eyes and body. Sign Language is a well-structured language with a phonology, morphology, syntax and grammar. Sign language is a complete natural language that uses different ways of expression for communication in everyday life. Sign Language recognition system transfers the communication from human to human-computer interaction. The aim of the sign language recognition system is to present an efficient and accurate mechanism to transcribe text or speech, thus the "dialog communication" between the deaf and hearing person will be smooth. There is no standardized sign language for all deaf people across the world. However, sign languages are not universal, as with spoken languages, these differ from region to region. A person who can talk and hear properly (normal person) cannot communicate with deaf & dumb person unless he/she is familiar with sign language. Same case is applicable when a deaf & dumb person wants to communicate with a normal person or blind person. So, there are two main approaches used in the sign language recognition that is Sensor based and Vision based Approach.

Sensor Based Approach

This approach collects the data of gesture performed by using different sensors. The data is then analyzed and conclusions are drawn in accordance with the recognition model. In case of hand gesture recognition different types of sensors were used and placed on hand, when the hand performs any gesture, the data is recorded and is then further analyzed. The first sensor used was Data gloves then LED's came into existence. The invention of the first data glove was

done in 1977. Sensor based approach damages the natural motion of hand because of use
of external hardware. The major disadvantage is complex gestures cannot be performed using this method.

Vision Based Approach

This approach takes image from the camera as data of gesture. The vision based method mainly concentrates on captured image of gesture and extract the main feature and recognizes it. The colour bands were used at the start Gesture recognition is the process by which gestures made by the user are used to.

III. Hand Gesture Recognition

Hand gesture recognition provides an intelligent, natural, and convenient way of human–computer interaction (HCI). Sign language recognition (SLR) and gesture-based control are two major applications for hand gesture recognition technologies. SLR aims to interpret sign languages automatically by a computer in order to help the deaf communicate with hearing society conveniently. Since sign language is a kind of highly structured and largely symbolic human gesture set, SLR also serves as a good basic for the development of
general gesture-based HCI. In this paper we are discussing work done in the area of hand gesture recognition and analyze the methods for recognition of hand gesture.

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IV.Existing system

The difficulties faced by hearing and speech impaired people or physically challenged people in communicating with others. Hand gesture recognition based man-machine interface is being developed vigorously in recent years. I am designing real time communication system enables differently impaired people or physically challenged people to communicate among themselves without an intermediate human translator. The aim of this work is to evaluate different segmentation processes specific to hand gesture recognition**.** Recently, there has been a surge in interest in recognizing human hand gestures. The gestures in the system belongs to sign language. In sign language, every gesture has an assigned meaning for the pupose of recognision. One of the major challenges in hand gesture recognition is to give the output for the different hand image effectively in varying the background and changing lighting condition Different applications which make use of hand gesture, may involve significant motion of the hands or simple undynamic pose depending on the choice of the system. The first stage, as displayed in the figure, is mostly related to the hardware of the system and the way data for the recognition process is gathered. Preprocessing is the second stage. In this stage filtering processes for smoothing the image, edge-detection are occured.

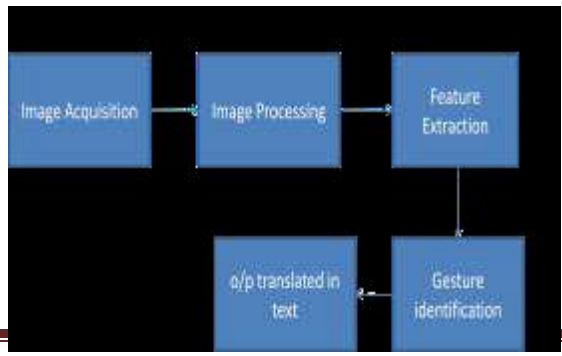

Fig 1: A general gesture recognition system

Feature extraction is part of the data reduction process and is followed by feature analysis.That is, techniques should find shapes reliably and robustly whatever the value of any parameter. The most important parameter is position, its rotation ,size it appears. The features of the input are then measured in one of the possible way to make a decision about which gesture the system is most likely subjected to in the fourth stage, also known as evaluation stage. Explicitly specifying features is not easy. Therefore, transformed images are taken as input, and features are selected implicitly and automatically by the classifier.

We update all the weights in the output layer in this way. 4. Calculate the Errors for the hidden layer neurons. Unlike the output layer we can't calculate these directly (because we don't have a Target), so we Back Propagate them from the output layer (hence the name of the algorithm). This is done by taking the Errors from the output neurons and running them back through the weights to get the hidden layer errors. For example if neuron A is connected as shown to B and C then we take the errors from B and C to generate an error for A. ErrorA = Output A (1 - Output A) (ErrorB WAB + ErrorC WAC) Again, the factor "Output (1 - Output)" is present because of the sigmoid squashing function. 5. Having obtained the Error for the hidden layer neurons now proceed as in stage 3 to change the hidden layer weights. By repeating this method we can train a network of any number of layers. NN are encouraging, especially in some fields like pattern recognition. A proposed system is used to indentify the gesture from the input image as well as it calculates the accuracy of the character at the output. The ecognition system accuracy is found to be lies above 90%. So we conclude that back propogation neural network has better accuracy. The proposed system is designed for static images. Future work can be done using dynamic images.

IV.Proposed System

In this project, the hand movement of a user is mapped into mouse inputs. A web camera is set to take the live video continuously and then from this video various images are being captured by using MATLAB. The user must have a particular color marker or pointer in his hand so that when the web camera takes an image it must be visible in it. This color is detected from the image pixel in MATLAB and object detection is used to map pixel position into mouse input. Taking into account the size of image and resolution, scaling techniques need to be used like image processing or segmentation. Sixth sense technology can be further developed to include multimedia services like videos or saving images using hand gestures. This work aims to provide usual mouse operations using a camera based on colour detection technique. The user wears coloured gloves, the information from which is processed by the system. Individual frames of the video are separately processed. The processing techniques involve an image subtraction algorithm in MATLAB to detect colours. Once the colours are detected the system performs various operations to track the cursor and performs control actions which are explained in further sections. No additional hardware is required by the system other than the standard webcam which is provided in every laptop or computer.The components used in this project can"t be specific, since this project is a prototype for all computers. As such, certain prerequisites are as follows

Webcam is a necessary component for detecting the image. Sensitivity of mouse is directly proportional to resolution of camera. If the resolution of camera is good enough, an enhanced user experience is guaranteed. The webcam serves the purpose of taking real time images whenever the computer starts. On the basis of gestures and motion of fingers, system will decide the respective action.

Hand gloves as shown in figure 1 with a color is a necessary component here. It is essentially the first step of the project. The gloves will have different colors painted on different fingers. This clear distinction in colors will make the system faster and easier for the algorithm.

Toolchain for firmware

Matlab

MATLAB version greater than 2012a is used for making this project. Image Acquisition toolbox and Image processing toolbox is necessary for developing the firmware. Along with this, an updated version of Java is required. SDK and .NET is required in order to create standalone applications for windows based system.

In the object tracking application one of the main problems is object detection. Instead of finger tips, a color pointer has been used to make the object detection easy and fast. A circle blue sticker is used as a color pointer in this study. To simulate the click events of the mouse, three fingers serving as three color pointers has been used. The basic algorithm (see figure 1) is as follows:

- Set a pointer in the image
- Detect the pointer using the defined color information
- Define the region and the center of the pointer and draw a bounding box around it
- Track the motion of the pointer
- Move the cursor according to the position of the center of the pointer
- Simulate the single and the double left click and the right click of the mouse.

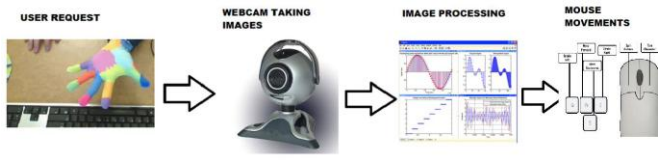

Fig 2: Overview of system

Fig 3: Input Image

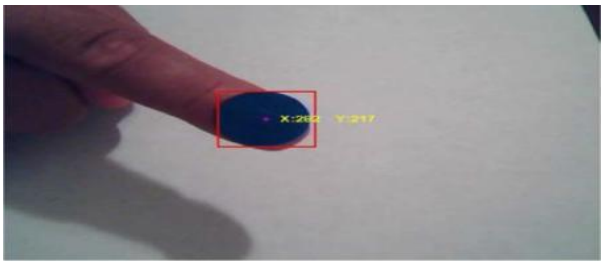

Fig 4: Detected Center

Morphology can be said to be a set of image processing operations that processes images based on their shapes. A structuring element is applied to an input image that gives a similar sized output image. The respective input image is compared with its neighbors, thereby giving a value for the output image. The factors of the neighborhood such as shape and size can be decided by the programmer, thereby constructing programmer-defined morphological operations for the input image. The most basic morphological operations are dilation and erosion (see figure 12, figure 13). Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. According to the structuring element used, the number of pixels added or removed will differ. In the morphological dilation and erosion operations, the features of any pixels in the output image is determined by applying a specific rule to the corresponding pixel and its neighbors in the input image. Whether the operation is dilation or erosion can be determined from the rule that has been applied to the image pixel.

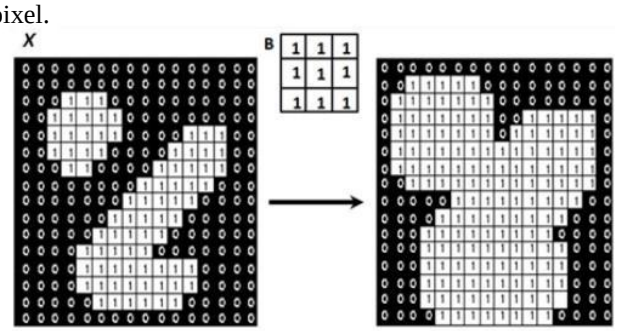

Fig 5: Dilation

Fig 6:Performance Analysis

V.CONCLUSIONS

The system architecture that has been proposed will completely change the way people would use the Computer system. Presently, the webcam, microphone and mouse are an integral part of the Computer system. This project will completely eliminate the necessity of mouse. Also this would lead to a new era of Human Computer Interaction (HCI) where no physical contact with the device is required. The use of object detection and image processing in MATLAB for the implementation of our proposed work proved to be practically successful and the movement of mouse cursor is achieved with a good precision accuracy. This technology can be used to help patients who don"t have control of their limbs. In case of computer graphics and gaming this technology has been applied in modern gaming consoles to create interactive games where a person"s motions are tracked and interpreted as commands. Most of the applications require additional hardware which is often very costly. The motive was to create this technology in the cheapest possible way and also to create it under a standardized operating system. Various application programs can be written exclusively for this technology to create a wide range of applications with the minimum requirement of resources.

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