Operating an Application Using Hand Gesture Recognition System

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ABSTRACT: In today's modern age of technology the Human Computer Interaction is at its zenith of innovation. However, there is lack of interfacing technologies to manipulate real-time behavior for operating various computer systems, software or devices. Even though to overcome this problem there are several alternative solutions, like speech recognition system, color marker based or glove based interfacing devices. But these devices are less portable have complex structure and less accuracy. So to recover these disadvantages, we are introducing the concept of hand gesture recognition system using only web camera of laptop. This will help to use real time interfacing in digital world without any additional sensors or additional hardware. Its simplicity improves efficiency and portability of system, making the project extensively useful.

KEYWORDS: Human Computer Interaction: speech recognition: color detection; real-time behavior;software; hardware.

I. INTRODUCTION

In everyday life we use various communication tools to communicate with the world surrounding us. One might think that the word or language is the one of the most important tool that is used during communication. But there are lots of other important factors present in process of communication, these factors are as important as word or language. Some of these factors are facial expressions, eye contact, speaking tone, body movement or hand gestures. These aspects of communication help us to express our message in more natural and straightforward way than other way of communications like letters or emails does. If these elements of communications are so important in everyday interaction, why not to try and use this factors to communicate with the digital world?[1]

Some factors of communication mentioned above, are already being used to interact with computer and other systems. Some examples are face detection, speech recognition system, retina scanning biometrics and motion detection sensors. But one of the most common elements of communication is not widely used for computer interaction, hand gesture. We often use hand gesture in communication with people in real world, we can use hand gesture to interact with the digital world also. This will give the field of Human Computer Interaction the natural method to interact with computer systems, and will make interaction with computer more real-life and easy.

There are some existing technologies that use hand gesture to interact with computer, but they are either highly expensive or cumbersome to use in daily life. So, in this paper we are introducing the system that can use simple hand gestures to operate computer applications and other devises.[1] [5]

II. RELATED WORK

As stated earlier, there are some technologies which use hand gesture as a medium to interact with various computer systems and devices. Some of these technologies are mentioned bellow:

Wired gloves:
With the help of magnetic pulses and some tracking sensors, these gloves report the rotation and position of hand. Additionally, some of these gloves are advanced to the extent that they can provide input of sense of touch or slight bending of the finger. TheDataGlove was first commercially available hand-tracking glove-type device. This DataGlove could detect hand position, movement and finger bending. This technology constitutes lots of fiber-optic cables. Light pulses are created and when the fingers are bent, light leaks through small cracks and the loss is registered, giving an approximation of the hand pose. Such use of cables made gloves expensive and fragile.[2] [6]

Depth-aware cameras:

We can create approximate 3D representation of the view by generating a depth map of what is being seen through the camera at a short range, with the help of some specialized cameras such as structured light or time-of-flight cameras Due to their short range capabilities, these cameras can be effective for detection of hand gestures.[4]

Controller-based gestures:

These controllers act as an extension of the body due to this when gestures are performed, some of their motion can be conveniently captured by software. Mouse gestures are one such example, where the motion of the mouse is correlated to a symbol being drawn by a person's hand.[4]

III. PROPOSED SYSTEM

To elude all the complexities and high cost solutions to operate computer applications with gesture, we propose simple hand gesture recognition system that can operate only on web camera of laptop and simple software. This system will help to communicate with computer software directly with your hand and needs no extra hardware or sensors. Only thing required is our software and the system to operate on.

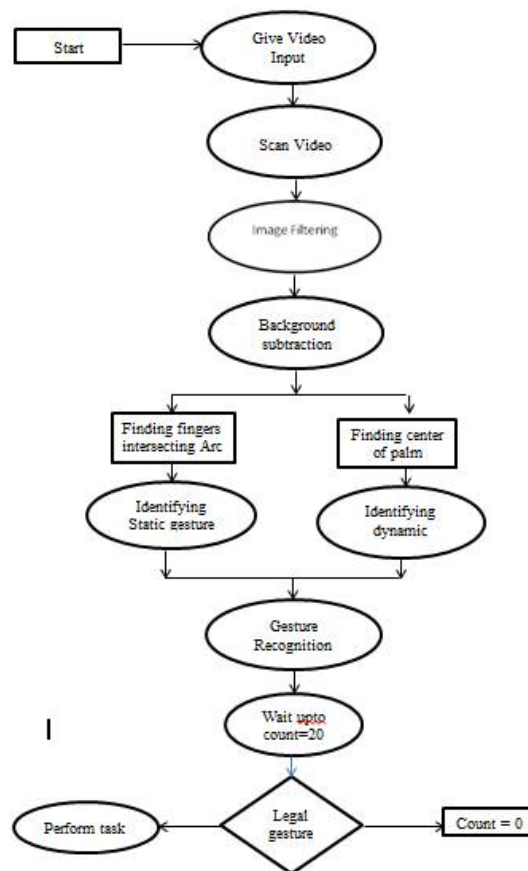Figure given bellow shows the operating mechanism of proposed system.

Fig.1. Proposed system.

- First we will need to access the web camera and obtain an input for system in form of video.
- Then scan this video input and perform background subtraction on it.
- Generate an arc of reference and find fingers intersecting that arc.

- Identify number of fingers intersecting that arc and sort out the assigned static gesture.
- Main gesture recognition process.
- Find out whether gesture is authentic or not.
- If gesture is authentic perform assigned gesture else reset the process.
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IV. METHODOLOGIES USED

A. *Background subtraction:*

Background subtraction is a major preprocessing step in many vision based applications. For example, consider the cases like visitor counter where a static camera takes the number of visitors entering or leaving the room, or a traffic camera extracting information about the vehicles etc.In all these cases, first you need to extract the person or vehicles alone. Technically, you need to extract the moving foreground from static background. If you have an image of background alone, like image of the room without visitors, image of the road without vehicles etc, it is an easy job. Just subtract the new image from the background. You get the foreground objects alone. But in most of the cases, you may not have such an image, so we need to extract the background from whatever images we have. It became more complicated when there is shadow of the vehicles. Since shadow is also moving, simple subtraction will mark that also as foreground. It complicates things. Several algorithms were introduced for this purpose.[7][8][9]

Fig.2. Input Image.   Fig.3. Image after background subtraction.

B. *Arc of reference:*

In this project we use arc with white color to identify how many fingers are in image. This is simple and fast technique to identify numbers of fingers and to perform task assign to that figure count ex. In this project to control VLC media player we assign single finger for Play or Pause video stream.

When hand or fingers intersect this white color arc then by comparing pixel color values of arc and skin color pixel we can easily count how many fingers are intersecting that arc and can count number of fingers.

Due to this arc of reference there is no need to scan and compare all pixels in image. This will help to improve speed of processing. Simply by scanning pixels in arc we can identify number of fingers.

Advantage of Arc of Reference

- No need to process all pixel in image
- Fast algorithm to identify number of fingers intersecting
- Easy to understand to user how to show gesture in frame

Fig.4. Image after background subtraction.

Above figure illustrates an example of the gestures used in a system that correspond to the numbers from zero to five. Note that the separation of the individual fingers is relevant to the detection of these gestures.

V. RESULTS AND ANALYSIS

Finger Count	Inputs					Output
1.						Play / Pause
2.						Full Screen
3.						Volume Up
4.						Volume Down
5.						Stop Playing

Fig.5. System output with different inputs.

We can use these finger counts to perform different actions. For instance in this project we are operating a media player using hand gesture, some of the possible operations can be performed using hand gesture are listed below:

1 Finger: Play/Pause video in media player

2 Fingers: Full screen the video in media player
3 Fingers: Increases the volume of media player
4 Fingers: Decrease the volume of media player
5 Fingers: Stop playing video in media player

VI. APPLICATIONS

A. *Operating the media player:*

Basic purpose of developing the system is to operate the media player using hand gesture. Here for experiment we have used the VLC media player to be operated using our hand gesture recognition system. By using this hand gesture recognition system we have the privileges to handle the most basic operations of media player like play, pause, volume up, volume down and full screen, etc.[9]

The best thing about this gesture recognition system is we don't need any additional sensors or hardware which makes system remarkably cost efficient. Additionally, you can operate the media player bare-handedly making the system user friendly.[9]

B. *Operating other applications:*

This hand gesture recognition system could be used for operating other applications as well. For instance, we can handle web browser, image viewer, reader, etc. Only once we have to assign the operations to gesture and we are ready to operate that application.

There are various basic operations in various applications like:
1. Browser: New tab, Previous tab, Next tab, Reload, Home, etc.
2. Image viewer: Next image, Previous image, Zoom in, Zoom out, Close, etc.
3. Reader: Page down, Page up, Zoom in, Zoom out, close, etc.

VII. CONCLUSION AND FUTURE WORK

Finally with analysis of our daily life it is concluded that gesture is most basic and natural part of the human interaction. So using gesture as communication medium between human and computer will help to bridge the real word with digital world. Moreover to use this system there is no need of extra sensors or hardware, which make this system cost efficient and simple. And anyone can use this system with simple training. Hence it is fair to say that this system will play vital role in advancement of Human Computer Interaction and will be a milestone in User Interfacing.[9]

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