

Hand Gesture Recognition Using Open CV

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Abstract: When you use gesture, you are entering into a whole history of human communication, because there is no language that exists entirely without gesture (a fun fact to bring up at parties). People can't communicate without gesture. It's so connected to intention that there is a phrase "empty gesture," used to mean an action or movement that is without genuine feeling. The research effort centralizes on the efforts of implementing an application that employs computer vision algorithms and gesture recognition techniques which in turn results in developing a low cost interface device for interacting with objects in virtual environment using hand gestures.

Keywords: Computer Vision, Hand Gesture, Hand Posture, Human Computer Interface.

I. INTRODUCTION

We are interested in creating an alternative, a natural interface that provides a way to interact with the real world. The user should be able to reach out, grab, point and move 3D objects just as we do with real objects. These challenges open a new direction for human-computer interaction [HCI] which is manipulated with computer vision techniques and it is possible to build an advanced input device.

These devices can be implemented and upgrade to the new input devices in the future. It gives the input command to the computer rather than just a function of taking photo or record video. We can make more changes to transform these computer vision devices to become an input command device to reach the function as an alternative to keyboard or mouse[1].

One of the ways to give signal to computer vision devices is by using hand gesture. More specifically hand gesture is used as the signal or input modality to the computer. These will benefits the entire user without using a direct device and can do what they want as long as the computer vision device can sense it. These make computer user easier than using the keyboard or mouse.

The future computer or laptop may eliminate the use of keyboard and mouse by substituting with a vision-based interpretation devices. Interaction between humans comes from different sensory modes like gesture, speech, facial and body expressions. The main advantage of using hand gestures is to interact with computer as an on-contact human computer input modality.

The state of art of human computer interaction presents the facts that for controlling the computer processes gestures of various types of hand movements have been used [4].The present research effort defines an environment where a number of challenges have been considered for obtaining the hand gesture recognition techniques in the virtual environment.

Being an interesting part of the Human computer interaction hand gesture recognition needs to be robust for real life applications, but complex structure of human hand presents a series of challenges for being tracked and interpreted. Other than the gesture complexities like variability and flexibility of structure of hand other challenges include the shape of gestures, real time application issues, presence of background noise and variations in illumination conditions [4].

The specifications also involve accuracy of detection and recognition for our application presents a more effective and user friendly methods of human computer interaction intelligently with the usage of hand gestures. Functions of mouse like controlling of movement of virtual object have been replaced by hand gestures.

The challenges encountered are noisy environment which creates a big problem or an issue on the detection and recognition performance of human hand gestures. The application has been designed to be cost effective and uses low cost tools like web cam for capturing hand as input.

II. STATE OF ART

In the dawn of hand gesture troubleshooting was done using various mechanical devices to obtain information of the gesture being performed[4]. One of the most widely used and accepted examples for hand gestures recognition is hand glove (data glove).

Evolution of computer hardware improved a lot of in present scenario this also effects the performance of computing. Enhancements or advanced use of gesture recognition has replaced the role of data gloves to non wearable devices due to the additional costs of gloves and their complications in detection.

One of the major drawbacks of data glove is that it is cumbersome with the limitation of hand movement.

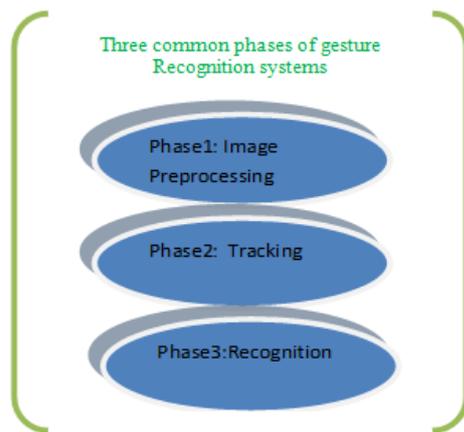


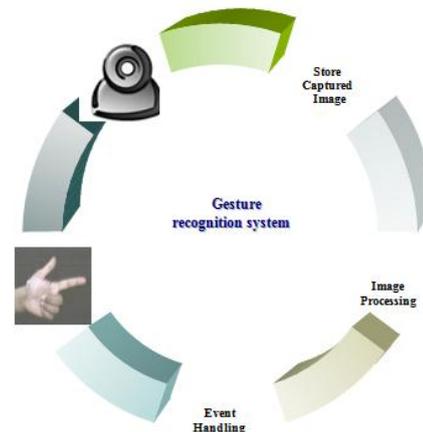
Figure 1. Three common stages of gesture recognition systems

Vision based approaches are preferred more than wearable devices in hand gesture recognition. Generally there are three stages in most of the gesture recognition systems [4]. The three stages may be enumerated as image pre – processing tracking and recognition stage as shown in Figure 1.

In tracking, there are several researchers who have done the similar research like Viola-Jones based cascade classifier, commonly used for face For tracking Viola-Jones and several other researchers have developed algorithms used for face tracking in rapid image processing like HAAR cascade classifier. This is presently one of the robust detection techniques under different constraints like noise .Gesture as input of human computer interaction based applications is an emerging field in which many researchers have worked and proposed different practical techniques. Jain implemented a vision based hand gesture pose estimation based application for mobile devices.[4]

Another hand gesture recognition method based on input-output Hidden Markov Models of tracking skin color blobs was proposed by Marcel et al. Controlling VLC media player using hand gesture recognition is done in real time environment using vision based techniques. The sign language tutoring tool studied by Aran et al. which their research designed to teaching the fundamental of the sign language in interactive way. Liu and Lovel implemented a technique for real time tracking of hand capturing gestures with the use of a web camera, personal computer and image processing algorithms making it more users friendly. Chen et al. implemented hidden Markov model technique for training the hand gesture for recognizing the hand postures. Nevertheless, this model is more complicated in training the hand gesture equated with Cascade classifiers. Lee et al. developed a Virtual Office Environment System (VOES), in which avatar is used navigate and interact with other participants. Contemporary works in hand gesture recognition by many researchers show that hand gesture system can also be practically implemented into several type of application systems and various environment. In the present research

effort, we will consider these aspects by taking it as a reference to a smart interaction environment of virtual object manipulation and control. Here the user can execute different gestures [4].



III. SYSTEM OVERVIEW

During implementation one thing was clear that a system is going to be developed which can capture a hand gesture performed by the user in front of web Cam, this capture image is then proceed to identify the valid gesture through specific algorithm & execute the corresponding operation[3].

The overall implementation process is described as follows:

Human Generated Gesture: As a first step of implementation user will show one gesture. The gesture should be constant for some period of time, which is necessary for dynamic processing.

These gestures should be already defined as valid gesture for processing.

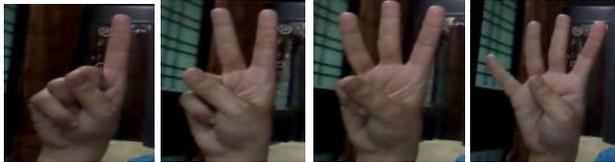
Web Camera: The purpose of web camera is to capture the human generated hand gesture and store it in memory. The package called Emgu-CV is used for storing image in memory and again calling the same program after particular interval.

Image Processing Algorithm: This carries the major portion of implementation. First the captured image is pre processed by techniques like color space detection, color space conversion [YCrCb, HSV, RGB] & differentiation, Skin color detection using open cv [Emgu –cv wrapper] & finally line segment detection for finger detection. The algorithm will count the number of fingers shown by user, which will work as input for next processing.

Event Handling: Once the gesture is identified the appropriate command for it will be executed. This commands will call the events for controlling the Home appliances Or Machine Operations.

Back To Capturing Gestures: Gesture recognition is a dynamic process so once particular gesture is identified and appropriate control command is executed it will again go to capture next image and process it accordingly.

Anticipated Static Gesture Set: Static gesture is a specific posture assigned with meaning. Following are the static gesture set specified for the proposed system with the specific meaning. Application interface will be provided after recognition of specified posture for action. Simplicity and user friendliness were taken into consideration for the design of anticipated posture set[2][3][5]



Technological Consideration

This paper involves analysis and identification of HAND GESTURES to perform appropriate control operations using C#.NET and Open Computer Vision/Image processing. Image processing is done using EMGU-CV. Image processing is the art and science of manipulating digital images. Basically an image is just a rectangle of colored pixels. Processing an image is simply a matter of calculating a new color for each pixel. The new color of each pixel can be based on the existing pixel color, the color of surrounding pixels, other parameters, or a combination of these elements.

Emgu CV is a cross platform .Net wrapper to the Intel Open CV image processing library. Allowing Open CV functions to be called from .NET compatible languages such as C#, VB, VC++, Iron Python etc. The wrapper can be compiled in Mono and run on Linux / Mac OS X.

IV. SYSTEM REQUIREMENTS

The various software required while developing the system are Java Development Kit, Jcreator, Java Media Framework. Image Background should be plain while running the application. Web Camera of appropriate resolution should be used

4.1 Software Interface: A set of instructions or program required to make hardware platform suitable for desired task is known as software. Software can also be defined as the utility programs that are required to drive hardware of computer.

- Operating system- Microsoft Windows 7 SP 1 or above
- Microsoft Visual Studio 2010
- Visual C# compilers (for Windows)
- Supporting Webcam Drivers

4.2 Hardware Interface: All the physical equipment's i.e. input devices, processor, and output device & inter connecting processor of the computer s called as hardware.

- Hard Disk minimum of 40 GB.
- RAM minimum of 2 GB.
- Dual Core and up ,15" Monitor.
- Integrated webcam or external webcam (15 -20 fps).

V. APPLICATIONS

The concept of gesture recognition has many applications include automated homes, operating visual devices like television solely with gestures and also medical applications Meanwhile, this project deals with opening of various applications like Microsoft office ,windows media player, internet explorer etc.

VI. FUTURE ENHANCEMENTS

1. Without any dark background hand gesture will be detected from the image.
2. More sophisticated ways of Gesture recognition from various other human actions will take place instead of just hand gestures.
3. Voice recognition system will be coupled with gesture recognition system which will then completely remove the requirement of hardware like Key-board and Mouse.

VII. CONCLUSION

This paper presented a technique to find the number of fingers present in the hand gesture. They are used in numerous applications. The further research studies are going on about this topic to obtain the necessary requirement[3]. The main aim of the paper is implementing real time gesture recognition. The primary goal of the project is to create a system that can identify human generated gestures and use this information for machine control and in future can be extended to the more general scenario like appliance control. The computer vision algorithms will also have to be developed further.

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