

Cursor Movements Controlled By Real Time Hand Gestures

K. Madhuri¹, L. Praveen Kumar²

¹Corresponding Author

Department of Electronics and Communication Engineering
CVSR College of Engineering, Hyderabad, India
madhuri.kantu@gmail.com

²Assistant Professor

Department of Electronics and Communication Engineering
CVSR College of Engineering, Hyderabad, India
praveenkumar.lendale@gmail.com

Abstract: *Computer has influenced our life in such a way that it is very difficult to sustain without a computer. Hence, we are explaining a mechanism, which helps the user to operate the computer with ease. This paper discusses a new approach for cursor movement using real time hand gestures. This explains whether, how to design human-computer interface and to regulate the set of motions of human hand. As we use empty hand for controlling the movement of cursor on pc, this system totally eliminates the usage of sensors and batteries. Here we propose to change the hardware design. Most of the existing technologies mainly depend on changing the mouse parts features like changing the position of tracking ball and adding more buttons. We use a camera, image comparison technology and motion detection technology to control mouse movement and implement its functions.*

Keywords: Gesture, Hand gesture recognition, Human Computer Interaction (HCI).

1. Introduction

Computers changed the world a lot. It helped man step forward into the future. Thanks to computers, space exploration came true, new designs of vehicles and other transportation were made; entertainment became more entertaining, medical science made more cures for diseases, etc. The computers impacted our lives in many ways. They did make life a lot easier. Without computers, the world would be a harder place to live in. The term Gesture is defined as “movement to convey meaning” or “the use of motions of the limbs or body as a means of expression; a movement usually of the body or limbs that expresses or emphasizes an idea. [1] The main purpose of gesture recognition research is to identify a particular human gesture and convey information to the user pertaining to individual gesture. From the corpus of gestures, specific gesture of interest can be identified, and on the basis of that, specific command for execution of action can be given to system. Overall aim is to make the computer to understand human body language thereby bridging the gap between machine and human. Hand gesture recognition can be used to enhance human-computer interaction without depending on traditional input devices such as keyboard and mouse. In human-human interaction, multiple communication modals such as speech, gestures and body movements are frequently used. The standard input methods, such as text input via the keyboard and pointer/location. Information from a mouse, do not provide a natural, intuitive interaction between humans and machines. Therefore, it is essential to create device for natural and intuitive communication between humans and machines. Furthermore, for intuitive gesture-based interaction between human and computer, the computer should understand the meaning of gesture with respect to society and culture. The ability to understand hand gestures will improve the naturalness and efficiency of human interaction with computer, and allow the user to

communicate in complex tasks without using tedious sets of detailed instructions. This interactive system uses web cameras to identify humans and recognize their gestures based on hand poses. In this system totally eliminates sensors, batteries usage, we use empty hand for controlling the movement of cursor in PC.

2. Related work

Vision-Based Human-Computer Interaction through Real-Time Hand Tracking and Gesture Recognition Vision-based interaction is an appealing option for replacing primitive human computer interaction (HCI) using a mouse or touchpad. We propose a system for using a webcam to track a users hand and recognize gestures to initiate specific interactions. The contributions of our work will be to implement a system for hand tracking and simple gesture recognition in real time [2]. This paper brings out an innovative idea to use the camera as an alternative to the mouse. The mouse operations are controlled by the hand movement that is captured by the camera.

3. Frame work

3.1 Pre-Processing

The input image has a lot of noise. So, the image has to be pre-filtered so that the hand in the image can be tracked with a much higher accuracy. The input image is converted into HSV space image. This is done according to the paper [3], which allows the proper color recognition without the lighting conditions affecting the overall algorithm. Once the image is in the HSV space then the image is subject to a HAAR classifier.

3.2 Hand Recognition

Before the user starts performing gesture on the screen the hand must be recognized. For this the user must place the hand before the camera and be detected, this allows only the hand to be recognized and no other object, hence noise is eliminated from input. We use the HAAR classifier to perform the hand recognition. Viola and Jones devised an algorithm, called Haar Classifiers, to rapidly detect any object, including human faces, using AdaBoost classifier cascades that are based on Haar-like features and not pixels [4]. HAAR classifier [5] is used to accurately recognize facial features. Detecting human facial features, face and such as the hands requires the Haar classifier cascades to be trained first. In order to train the classifiers, these gentle AdaBoost algorithm and Haar feature algorithms must be implemented. To train the classifiers, two set of images are needed. One set contains an image or scene that does not contain the object i.e. the hand that is to be detected. This set of images is referred to as the negative images. The other set of images, the positive images, i.e. the hand. The location of the objects within the positive images is specified by: image name, the upper left pixel and the height, and width of the object [6]. The negative images could be anything ranging from different people to walls colors and so on.



Figure 1: Negative Images



Figure 2: Positive images

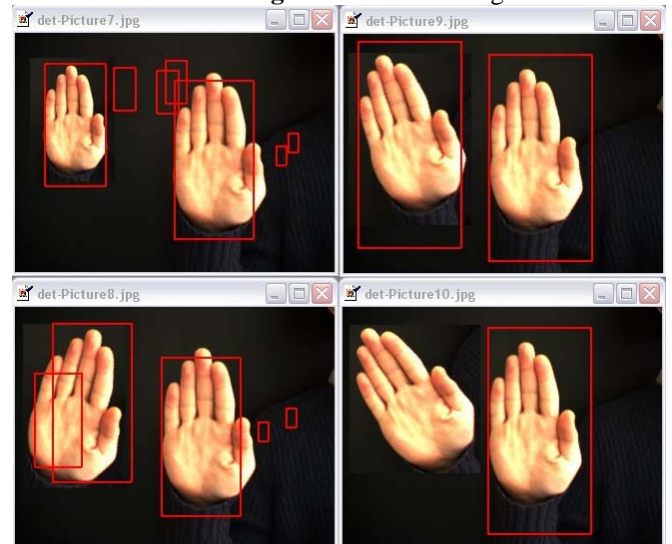


Figure 3: Hand Recognition using Haar Cascade

3.3 Open CV

Intel developed an open source library devoted to easing the implementation of computer vision related programs called Open Computer Vision Library (OpenCV). The OpenCV library is designed to be used in conjunction with applications that pertain to the field of HCI, robotics, biometrics, image processing, and other areas where visualization is important and includes an implementation of Haar classifier detection and training. One of OpenCV's goals is to provide a simple-to-use computer vision infrastructure that helps people build fairly sophisticated vision applications quickly [7]. This paper uses OpenCV library to detect a hand in an image using its Haar Cascade hand Detector.

4. Proposed method

Main objective of a proposed system is

- The proposed embedded systems will used to improve the Human computer interaction by merely showing the hand gesture in front of camera.
- Single web camera is used.

4.1 Microcontroller

Controller controls all the processing and hardware units. This component then mainly utilizes:

4.1.1 ROM

To store embedded software program to process the system flow.

4.1.2 Processor

To execute the software program stored in to ROM

4.1.3 Ports

To communicate with external devices like driver controller or camera controller.

4.1.4 Camera Controller

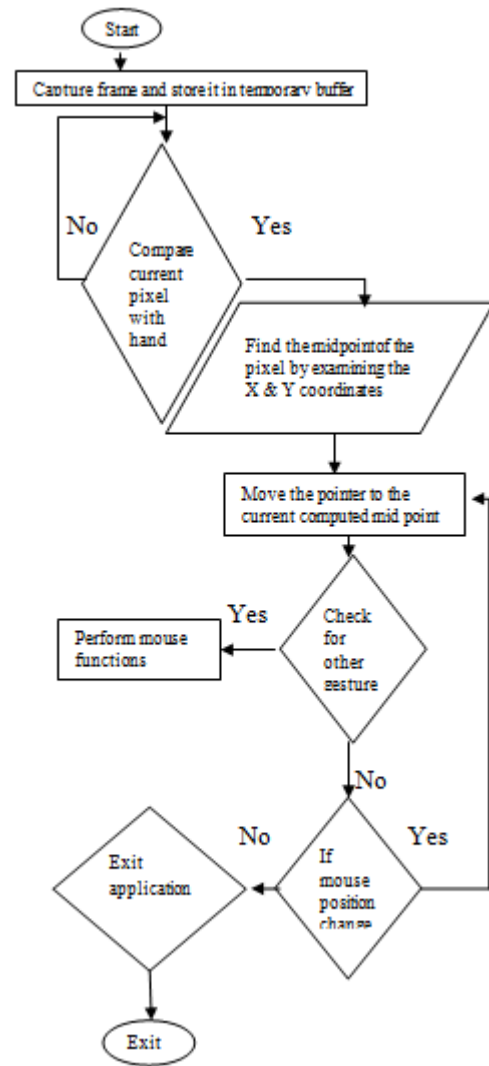
This unit will capture the video input for the system using frame capturing technology. Any camera is first controlled through its driver software which is provided by camera hardware. This driver is also customized for specific operating system. Now this application needs to contact the operating system in order to access the camera. Once this process is completed, live cam view is displayed in supportable control like picture box but this is real time live view. So, it is not possible to process it directly so we need to get the current frame out of live streaming for processing. This is what we called it frame extraction and we load this frame in memory for fast processing. Even we got the frame, it is not easy to identify the color from it so we need to perform image processing here and as we know each pixel is made up of 3 bit of RGB so we try to extract RGB value for each pixel and we also try to compare those values with predefined values like what we do in pattern matching. All this process will be executed for next frame; here we are doing both frame capturing and frame processing, it is compulsory for both the processes to be synchronous for smooth performance. This is how real time image processing works and is utilized in this paper.



Figure 4: Physical Architecture

In computing, a cursor is an indicator used to show the position on a computer monitor or other display device that will respond to input from a text input or pointing device [8]. The cursor is moved on the screen by setting the coordinates for the desired position on the screen. The top-left corner is (0, 0) and the bottom-right is (X_MAX, Y_MAX). In the proposed system, the cursor is moved left, right, up and down by moving the hand right, left, towards the camera and backwards the camera respectively.

5. Flow chart



6. Conclusion

There are many approaches for hand gesture recognition, and each approach has its strengths and weaknesses. The strength of the proposed method in this paper is the open CV library and the advanced arm processor. The Proposed algorithm achieves 90% average recognition rate. In this process, we do not train the system with different hand images. Instead, we directly test the positive images using open CV. This is the major advantage of open CV. The drawback of the system is that it can not detect the actions performed by hand from long distances. Hence, in near future the system has to overcome this problem so that the actions can be performed from long distances, and improve the hand recognition rate.

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Author Profile



K. Madhuri received BTech degree from CMR College of Engineering and Technology in 2006-2010. She received M. Tech degree from CVSR College of engineering in 2010-2013.



Praveen Kumar Lendale was born in Devarakonda, Andhra Pradesh, India, in 1985. He received the B.Tech degree in Electronics and Communication Engineering from JNTU, Hyderabad, in 2008. He received the M.Tech Masters degree in Communication systems from Aurora Engineering, JNTU, Hyderabad in 2012. His research interest includes Digital Image Processing and Mobile communication.