ISSN: 2455 - 1597

ijergs
Open Access

International Journal of Engineering Research and Generic Science (IJERGS)
Available online at: https://www.ijergs.in

Volume - 11, Issue - 3, May – June - 2025, Page No. 118 - 122

Hand Gesture Recognition using Color Fingertip

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Abstract

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. To help understand what gestures are, an examination of how other researchers view gestures is useful. How do biologists and sociologists define "gesture"? How is information encoded in gestures? We also explore how humans use gestures to communicate with and command other people. Furthermore, engineering researchers have designed a variety of "gesture" recognition systems - how do they define and use gestures?

Keywords: Gesture recognition, Artificial Neural Network

Introduction

This paper deals with a system that allows users to give mouse inputs to a system without using an actual mouse. To the extreme it can also be called as hardware because it uses an ordinary web camera. A Gesture Simulated Mouse can usually be operated with multiple input devices, which may include an actual mouse or a computer keyboard. Gesture Simulated Mouse which uses web camera works with the help of different image processing techniques. The whole process of static gesture recognition can be divided into four phases, as shown in Figure 1. Each phase performs a specific task, whose result is passed to the next phase

Figure 1: Phases of Gesture recognition

The task of the first phase is to acquire an image, or a sequence of images (video), which is then processed in the next phases. The basic aim of the second phase is to optimally prepare the image obtained from the previous phase in order to extract the features in the next phase. Third phase is to find and extract features that can be used to determine the meaning of a given gesture. Feature, or a set of such features, should uniquely describe the gesture in order to achieve a reliable recognition. Such a feature, or a set of such features, should uniquely describe the gesture in order to achieve a reliable recognition.

Proposed Work

The recognition of hand gestures using visual input is not a trivial task. It involves several steps which need to be carefully designed. The first step is the modelling of gestures. Usually this means a mathematical representation of hands, pose and gesture trajectories which will be used in order to interpret a gesture. Interpretation of each gesture contains a large amount of ambiguity, as gestures are directly dependent on the context. Thus, it is clear that the success of a gesture recognition system relies on the gesture model to be chosen. Image database prepared first which has different

formats. Images can be either hand drawn, digitized photographs or a 3D dimensional hand. Photographs were used, as they are the most realistic approach. Two operations were carried out in all of the images. They were converted to greyscale and the background was made uniform. The extracted set of features which is consequently used in order to recognize a gesture is another important factor in the gesture recognition process. They are context dependent and the effectiveness of the system is based on them.

Gesture recognition basically implements using two type of methods- Glove based method and vision based method. Our proposed work based on glove oriented method. A Glove-Based Gesture Recognition system consists of cloth made glove, sensors, electronics for data processing and power supply. While worn by a user, the glove extracts features concerning the configuration of his/her hand together with its movement. By analysing and, thereafter, interpreting these features, one can extract information about the ongoing gesture. The proposed approach relies on the assumption that human perception of basic gestures is mainly based on the arm and not on the end effectors (palm and fingers).

Suppose that a system consists of N hand gestures and for each gesture M traces are stored in a database. Gesture complexity ranges from very simple ones, as simple as the hand moving either to the right or to the left or up or down, to more complex ones such as gestures representing letters or numbers. The acceleration of the hand is used as the data to represent a gesture rather than the hand position. The acceleration of the hand is measured at different time t using a single 3-axis accelerometer. Therefore, a trace of a gesture is basically a three column matrix representing the acceleration of the hand in the x-, y-, and z-directions. However, hand gestures inherently suffer from temporal variations. In other words, they differ from one person to another and even the same person cannot perfectly replicate the same gesture. This means that gesture traces can differ in duration depending on the user and the speed of the hand movement. Consequently, traces of the same gesture are of different a length which poses the first major challenge in developing a gesture recognition system. Recall that gesture traces suffer from inherent temporal variations, and therefore the

Conventional Euclidean distance is not applicable as a similarity measure between the gesture traces. Consequently, in our gesture recognition system, we resort to dynamic time warping to compute the similarities between the different gesture traces.

Finger Identification Method

1. This method checks the thumb and index finger. First, because, the distance of the thumb and forefinger is due to be the biggest among all adjacent fingers.
2. The baby finger is distinguished the finger which the head of a family which is apart from the thumb is far. The central finger is distinguished one which is the closest to forefinger in the meantime.
3. The remaining one is the ring finger.

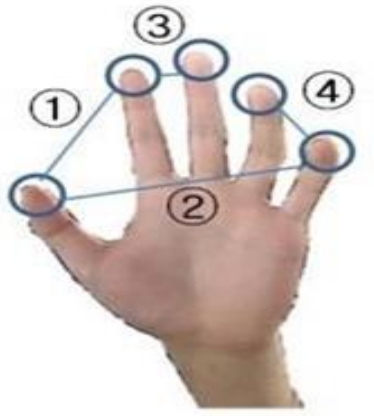

Figure 2: Finger Identification

After finger identification we create a bounding box for the region of interest and specify five different colors for each of the finger. After this create set of 10 gestures based on the recognition system of hand. These sign are basically based on the color detected in top position with their coordinated and angle made.

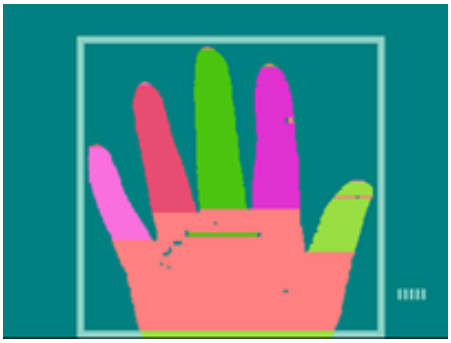

Figure 3: Each fingers with different colors

Figure 4: Example of a Gesture

For example, gesture number six shows in the figure 3 can be detected using figure width from extreme left to extreme right and other can be using finger distance from each other.

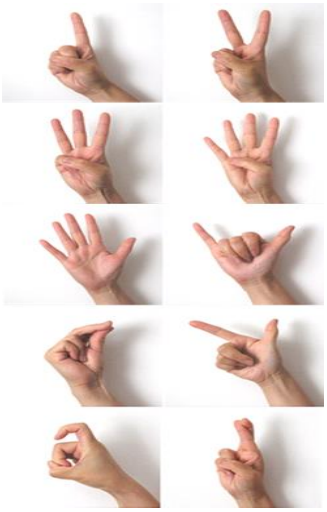

Figure 5: Ten Gestures of the system

Implementation

This section describes the internal working of the gesture recognition system defined in four phases**.**

Phase 1: First phase shows that user is moving the color in his hand in front of the webcam. Here webcam is taking the video and by image acquisition toolbox it is set to grab images from video.

Phase 2: Second phase is the important phase of all, in this phase the images which is coming from the video in a frame are taken and are compared with the database images that is the already saved color images in the database are then compared with the input color images then the image are taken after comparison. This is all done by image processing toolbox.

Phase 3: Third phase is the phase which shows that color image of input matches with the color image of database. This is done by image processing toolbox.

Phase 4: This is the final phase which shows that if images matches then the operations executes that is in this context can be adjusted as required.

Result analysis

I have tested this system over five different environments using five different users. Every time background colours and situation are different and then tested this system, result as described in the table1 below.

Table I

Result Analysis

User S	Gestures									
	1	2	3	4	5	6	7	8	9	10
1	√	√	√	√	√	√	√	√	√	√
2	√	√	√	√	√	×	×	√	×	×
3	√	√	√	√	√	×	×	√	×	√
4	√	√	√	√	√	√	√	√	×	√
5	√	√	√	√	√	√	×	√	√	√

* √ - Matched and × - Not matched

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Conclusion

In this paper, I presented fingertip tracking and hand recognition techniques. It presented natural user interfaces that allows user to do a task using different recognised gestures. This system is as interesting for future use and it needs only a fingertip of five different specified colours. As for future enhancement more gestures can be add and recognised using with same algorithm for multiple commands using hand gestures.

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