



## Gesture Recognition System

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### ABSTRACT

People say actions speaks louder than words. Gestures is a powerful mode of communication. Many people are known to gestures, a powerful communication medium among humans. Hand gesture recognition system has become more and more popular in today's world because of its various applications and the ability to interact with any machine efficiently through Human Computer Interaction (HCI). The main purpose of gesture recognition is to identify the gesture and deliver the necessary information based on it. This paper aims to brief the practical approach of hand gesture recognition through image processing.

Keywords: Gesture recognition, Hand gestures, Image processing, Human Computer Interaction.

### 1. Introduction to Gesture Recognition System

With the idea of gesture recognition, when you point your finger at the computer screen, the cursor will move accordingly. The input devices that we normally use can be rendered unusable with this theory. Basically, gesture recognition allows humans to communicate with machines and interact naturally without the use of any mechanical devices.

Gesture recognition can be performed using computer vision and image processing techniques. Most complete handheld interactive features first extract the defining visual features from the presence of a hand within the camera's field of vision. Then the tracking layer provides the temporal data mapping between successive frames, so the system needs to know "what's where" at all times. Finally the spatio-temporal data extracted from the previous layer is grouped and the resulting groups with labels associated with certain classes of gestures is assigned.

#### 1.1. Motivation

- Gesture communication is a powerful method.
- Gestures provide another modality that complements language for expressing one's thoughts.
- Using gestures for navigation makes things easier and more convenient for people with disabilities.

#### 1.2. Aim and Objective

##### Aim

This paper aims to brief the practical approach of hand gesture recognition through image processing techniques.

### Objectives

- The primary goal of gesture recognition research is to identify specific human gestures and provide users with information about those individual gestures.
- For sign language recognition from hand gestures.
- Computer recognition of hand gestures provides a more natural computer interface, allowing you to rotate the models just by pointing at them.

## 2. Literature Review

Gestures are a form of non-verbal communication in which visible physical actions, instead of or in combination with language, convey messages. Gestures are powerful means of communication between people. Facial gestures are so deeply embedded in our communication system that we often continue to use them when we are talking on the phone or a cell phone, or when we are talking to each other. Hand gestures provide a modality that clearly corresponds to language to express one's thoughts. Information relevant to hand gestures in speech is degree, thesis structure, spatial and temporal structure. A movement, usually of the body or limbs that expresses or emphasizes an idea. [1]

The main goal of gesture recognition research is to identify specific human gestures to users. Gesture modeling and recognition is a difficult task because gestures are dynamic in both form and duration. Sign language recognition from hand movements and hand poses is an active area of gesture recognition research for human computer interaction (HCI). Computer recognition of hand gestures provides a more natural computer technology interface, allowing people to point and rotate CAD structured models by rotating their hands. [2]

Hand gestures can be categorized into two types: (a) Static gesture (b) Dynamic gesture. Static gestures are specific hand configurations and postures represented by a single image, while dynamic gestures are gestural movements represented by a sequence of images. The main focus is on recognizing static gestures. [3]

Robots are electromechanical or effectively artificial hosts, most often motion-based machines influenced by computer programs and electronic circuits. It can also be used to improve people with disabilities. Gestures can be hands, fingers or eyes but the idea is the same. The goal of this project is to build a Human Computer Interaction system that can recognize human hand gestures and translate them into appropriate commands. These commands are used to power the mobile robot and accordingly perform the required tasks. The whole process has to be done in real time, so fast and efficient algorithms have to be used. Moreover, practical implementation of the system should consider practicality and ease of use. Systems like ours are meant to be used in everyday life, so they should be easy to use and efficient. [4]

## 3. Algorithm

### Image Processing Algorithm

Image processing is any form of information processing where the input taken is a photo or a video. The output does not necessarily have to be an image, but could be, for example, a set of image features or information related to the image features.

A pixel can be thought of as a tiny dot that contains information about an image. Thus, when you take a picture these small pieces of information are collected by your camera's sensors. A number of image processing techniques involve treating the image as two-dimensional signal and applying standard processing techniques.

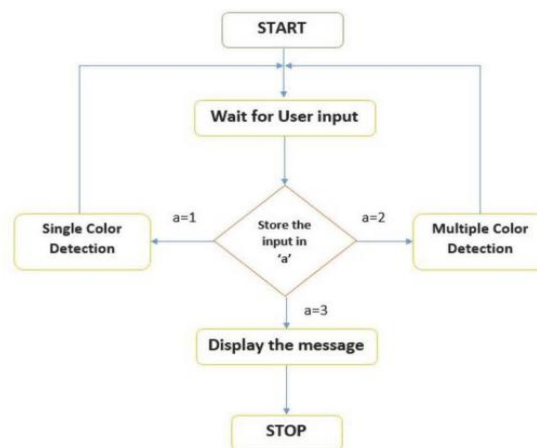


Fig.1 Flowchart of Image Processing

#### 4. Experimental Methodology

1. A webcam is a video camera that feeds or streams images to a computer network in real time. To send a signal to the microcontroller, first we need to receive images from a webcam of any laptop or a computer.
2. Once these image signals are received, they are processed using Image Acquisition Toolbox and converted into appropriate formats and different codes are assigned to them.
3. These signals with assigned commands are then transferred from a PC to a wireless RF module. If any signals are of analog nature then they are first converted to digital nature to be compatible with RF modules. (RF module is usually used for wireless control.)
4. RF receiver is then used to receive control commands. The commands received by the RF receiver are passed to the microcontroller.
5. The microcontroller then decodes these commands and sends them to the motor drivers that drive the DC motor.

➤ Image Acquisition Toolbox:

The Image Acquisition Toolbox controls acquisition parameters and integrates them into M-scripts, applications written in MATLAB.

To acquire data using Image Acquisition Toolbox, you must complete the following steps:

- Install and configure imaging devices.
- Create a video input object.
- Video stream preview.
- Set the properties of the image capture object.
- Get the image data.

➤ RGB Images:

When you take a picture, these small pieces of information are collected by your camera's sensor. This collected information is then stored in the information layer. Each layer represents three colors: red, green and yellow. The combination of these three colors make up all the colors we see in an RGB image.

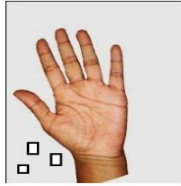

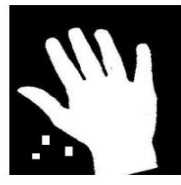

Process	Input	Output
RGB to Binary		
Noise Removal		

Fig.2 Captured Image to Binary Image

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## 5. Conclusion

This paper briefs about the overall procedure of hand gesture recognition. The method to hand gesture recognition proposed in this document is as simple as it is cost-effective. The system with the proposed algorithm has achieved an average detection rate of 80%. This compares well with the obstacles such as poor lighting and approximate thresholds. It can have technical problems with the finger detection, but they are unavoidable.

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