Journal of Engineering Sciences

Vol 11, Issue 7,July/2020

ISSN NO:0377-9254

HAND GESTURE RECOGNITION FOR PATIENTS MONITORING

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***Abstract*— Gestures are used for communication which involves movement of a part of the body, especially the hand usually to express an idea. Gestures can efficiently convey a rich set of facts and feelings. Hand gesture recognition is the process by which gestures made by the user are used to convey the information or for device control. Different methods have been proposed for acquiring information necessary for Hand gesture recognition system. In this "Hand Gesture Recognition for Patients Monitoring," the gesture recognition system is used for patients those who are all unable to move from their place. The gestures as input are then converted into a particular message using different methodologies, and that input will send to main monitoring hospital station through the mail.**

***Keywords*— Human Computer Interaction, Hand gesture recognition, Contours, Haar-Cascade**

1. INTRODUCTION

Sign language is a language which uses manual communication and body language to convey meaning or information. It is important language for persons with disabilities. **"Hand Gesture Recognition for Patients Monitoring",** uses image processing to produce understanding the sign. It keeps track of various hands parameters and provides data to analysis it and monitors system. It is depend on gestures language interpreter of the patients. This utility system has general facility due to it depend on monitoring the patients in different regions. If a patient ask to eat or something else, the system will help to achieve, what he wants. It is used to express of patient wishes. This method is the easiest way to help the patients, and what they need, when the patient unable to walk due to stroke or some other health problems, and the system completely depend on hands movements. The details of system consist of web camera connects with active system to monitor closely the patients. The idea of the system is to monitor the patient's hands. The movement of the patient will be interpreted and compared, depend on special movement build in the system. The system reject any gestures not exist. The error messages are displayed when the patient's gesture is out of system rules. In this system, the messages are passed through mail to the main hospital monitoring station.

2. PROJECT SCOPE

The main goal of this project is to develop a program implementing real time hand gesture recognition for hospital patients monitoring. The method proposed in this paper makes use of a webcam through which gestures provided by the user are captured, processed, and the function related to that gesture is carried out. The system has four phases namely,

Input Gesture

⇩

Intercepting the Gesture

⇩

Recognizing the Gesture

⇩

Executing corresponding commands

3. PROJECT DESCRIPTION

3.1. PROBLEM DEFINITION

"Hand Gesture Recognition for patients monitoring" is based on the concept of Image processing for patients like stroke or some other

health problems those who are all not able to move. It is used to express of patient wishes. This method is the easiest way to help the patients, and what they need, when the patient unable to walk due to stroke or some other health problems. The Performance of the proposed method highly depends on the hand movements, and the result of hand detection. It should use image processing techniques to distinguish the hand from the background, and then identify the hands to determine the gestures. The project has the following main tasks:

A. Patient's gesture capturing

- The Web camera used will be able to capture user images.

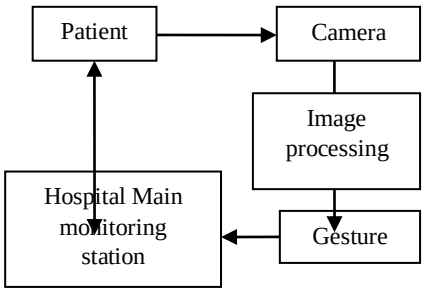
B. Image processing techniques and capture user images.

- Research about a different image processing techniques.
- Produce multiple frames and display the image in the RGB color space and display converted RGB image in new window.
- Extract skin colored pixels and convert every frame to binary image.
- Extract hand pixels from rest of the hand be extracting the largest contour of the detected skin regions.
- Identify hand gestures information.

C. Conveying information

- Mail the information about respective hand gesture to the main monitoring station to do the patient need or check for any emergency situations.

3.2. BLOCK DIAGRAM



3.3. PROPOSED SYSTEM

3.3.1 IMAGE PROCESSING

Images are stored as a collection of pixels. Color image consists of red, green, and blue value, which is combined to allow colors to be represented. Grayscale images are different however, "as pixels are represented by a single number ranging from 0 to 255, where 0 is very black and 255 is very white."

Image processing in computing is used to extract useful information from images to perform some specific tasks. Image processing generally involves three basic steps. Image segmentation, which involves image conversion between different color spaces to minimize the complexity of image. Skin detection, which gets rid of any unwanted background objects and noises associated with the image. Contour detection to locate an object in the image. Each of these stages will be discussed in detail below.

3.3.2. OVERVIEW OF THE PROPOSED SYSTEM

To extract features and recognize a gesture following method is proposed:

i. A Webcam who allows the user to capture the scene. This phase is called image acquisition.

ii. After capturing the image, next step is to detect the hand and separate the hand from the scene, because only hand gesture is needed for accurate classification. If hand is not separated from the scene it will affect the accuracy of the system while extracting and matching the features.

iii. Crop hand out of scene.

iv. Preprocessing steps, which are:

- Convert RGB to Gray Scale
- Gray filtering using Value
- Noise removal and smoothing
- Remove small objects other than hand
- Features extraction

v. Classification using Haar–Cascade classifier algorithm.

vi. Gestures information conveyed through mail.

4. MODULES DESCRIPTION

Hand gesture recognition system consists of following three modules they are camera module, detection module, interface module.

4.1. CAMERA MODULE

This module is responsible for connecting and capturing input through the different types of image detectors and sends this image to the detection module for processing in the form of frames. The commonly used methods of capturing input are data gloves, hand belts and cameras. In our system, we use the webcam inbuilt which is cost-efficient to recognize both static and dynamic gestures. The system has suitable provision to allow input from a USB based webcam as well but this would require some expenditure from the user. The image frames obtained are in the form of a video.

4.2. DETECTION MODULE

This module is responsible for the image processing. The output from camera module is subjected to different image processing techniques such as color conversion, noise removal, threshold following which the image undergoes contour extraction. If the image contains defects, then convexity defects are found according to which the gesture is detected. If there are no defects, then the image is classified using Haar-cascade to detect the gesture.

4.3. INTERFACE MODULE

This module is responsible for mapping the detected hand gestures to their associated actions. These actions are then passed to the appropriate application. The front end consists of three windows. The first window consists of the video input that is captured from the camera with the corresponding name of the gesture detected. The second window displays the contours found within the input images. The third window displays the smooth threshold version of the image. The advantage of adding the threshold and contour window as a part of the Graphical User Interface is to make the user aware of the background inconsistencies that would affect the input to the system and thus they can adjust their laptop or desktop web camera to avoid them. This would result to better performance.

5. METHODS DESCRIPTION

Hand Gesture Recognition for Patients Monitoring includes the following methods they are, Video Capturing and Preprocessing, Background Subtraction**,** Thresholding, Contour Extraction, Convex hull and convexity defects**,** Haar–Cascade classifier**,** The Gesture Vocabulary.

5.1. VIDEO CAPTURING AND PREPROCESSING

A webcam is used to capture the gesture images. After capturing the image, next step is to detect the hand and separate the hand from the scene because only hand gestures are needed for accurate classification.

Preprocessing is the process of change the size of the input image and also for color conversions. It includes steps,

i. RGB to Gray Scale

ii. Gray Filtering

iii. Binarize

iv. Noise removal and smoothing

v. Remove small objects other than hand

vi. Region filling

5.2. BACKGROUND SUBTRACTION

It is an efficient method to separate foreground from background**.** Background subtraction is a widely used approach for detecting moving objects in videos from static cameras. After figuring out the background, bring hand and make the system understand that hand is a new entry into the background, which means it becomes the foreground object. To take out this foreground alone, background subtraction has been used. After figuring of out the background model, calculate the absolute difference between the background model and the current frame difference image that holds the newly added foreground object.

5.3. THRESHOLDING

Thresholding, which is a simple segmentation method, is then carried out. It is applied to obtain a binary image from the gray scale image. Thresholding technique compares each pixel

intensity value (I) with respect to the threshold value (T). If I<T, the particular pixel is replaced with a black pixel and if I>T, it is replaced with a white pixel. A threshold value (T) of 127 is used in our work which classifies the pixel intensities in the gray scale image. Maximum value of 255, is the pixel value use if any given pixel in the image passes the threshold value. The two types of thresholding that are implemented are Inverted Binary Thresholding and Otsu's Thresholding. Inverted Binary Thresholding inverts the colours to be white image in a black background.

5.4. CONTOUR EXTRACTION

Contours are a useful tool for objecting detection and recognition in image processing. In our work, we have used contours to detect and recognize the hand from the background. The curves that link continuous points, which are of the same color, are called contours. Finding the contours is the first step which is like finding white object from black background in OpenCV. Hence, Inverted Binary Thresholding has been utilized during thresholding. The second step is to draw the contours which can be used to draw any shape provided the boundary points are known.

5.5. CONVEX HULL AND CONVEXITY DEFECTS

Fingers can be determined by finding convex hulls and convexity defects. The first step is to find the largest contour in the image which is assumed to be the hand. Then find the convex hull and convexity defects which are most probably the space between fingers. Convex hulls are vertices of the smallest convex polygon enclosing the contour. Convexity defects are the deepest points between convex hulls where convexity is violated. At this point, fingertips are essentially convex hulls. However, in some cases many convex hulls can be very closely grouped together tracing out the curvature of one fingertip, and one must reduce them to a just one point.

5.6. HAAR-CASCADE CLASSIFIER

For gestures like palm and fist where there are no convexity defects, Haar-Cascade classifier is used. A collection of positive images, a minimum of 10 original images, taken at different lighting conditions and angles is used. Each of the original images is cropped to contain only the object of interest. Collection of negative images, which doesn't contain the object of interest, a minimum of 1000 images is required. A description file for negative images is created by using create samples library. Each positive image is superimposed on a minimum of 200 images. A vector file is created based on superimposed images. Haar training will utilize a minimum of 100 images of size 20 * 20 and the training also can consist of 15 or more stages.

5.7. THE GESTURE VACUBULARY

This project currently provides following gestures for conveying information to main monitoring hospital station.

Figure 1 Bystanders Alert

Figure 2 Nurse Alert

Figure 3 Doctor Alert

Figure 4 Emergency Alert

Figure 5 Food Alert

6. RESULT

In this system, the captured image using web camera undergoes different process and display the following windows such us threshold window, gesture window and contour window.

Figure 6 Web Camera image

Figure 7 Threshold Window

Figure 8 Gesture Window

Figure 9 Contour Window

From the result, there are five fingers and its convexity defects count is 4. So, it represents the food alert which will send through mail to the main hospital station.

Table I. Accuracy Rate Analysis

Gestures	Test Samples	Accuracy Rate
 1	20	98%
 2	20	94%
 3	20	93%
 4	20	92%
 5	20	92%

7. CONCLUSION

The purpose of this application is to recognize hand gesture to present a new proposed model for stroke patients or with some other this kind of health problems, where these patients cannot move their bodies except hands. We build this system to read hands movements and translate these movements to requests carried out by the doctors. The performance of the proposed method highly depends on the result of hand detection. This research work focuses on the problem of gesture recognition in real time that sign language for patients. Research problem identified is based on Digital Image Processing using some techniques. The design is very simple and the signer doesn't need to wear any type of hand gloves, although this hand gesture recognition application can be run in an ordinary computer having a web camera.

8. FUTURE SCOPE

The future work will include recognition of dynamic two handed manipulation gestures for zoom an image, rotating an image and to experiment with larger gesture vocabularies to enhance the interaction flexibility to the system. Instead of Webcam a better and more accurate acquisition device can be used like ToF (Time of Flight) cameras which provide the depth information that can improve the performance of hand detection. So, in future works, machine learning methods and ToF cameras will be used to address the complex background problem and improve the robustness of hand detection.

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