

International Journal of Advance Research in Computer Science and Management Studies

Research Article / Survey Paper / Case Study

Available online at: www.ijarcsms.com

Desktop Music Controller Based on Hand Gesture Recognition through Web-cam

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Abstract: *The aim of this work is to perform various music player operations like play, stop, next, repeat and previous by using hand gesture recognition technique. It is done with the simple image processing performed on the image captured by the external or laptop webcam. This paper mainly deals with detecting and identifying the hand, the gesture and the skin to perform some specific tasks in the music player.*

Keywords: *Music Player, Gesture control, Convex Hull.*

I. INTRODUCTION

In traditional system mouse and keyboards are main interface between the human and machine. Nowadays, various techniques like vision detection, gesture detection techniques are use for interaction. Using this various new detection techniques user can communicate with the machine from a distance. Hand detection and recognition is an important research field by which various gestures can control a computer. The new generation laptops contain built in webcam, touch screen mobile phones with front camera has increased the use of applications working on gestures. This paper mainly focuses on controlling the music player with and without the use of keyboard and mouse. The algorithm used to achieve the best performance from the system is Convex Hull Algorithm. In this paper we are going to discuss about the various functionalities of Convex Hull Algorithm and how the music player will work using the similar algorithm.

II. RELATED WORK

This work is about mp3 music player with functions like Play, Stop, Next, Previous and Repeat Mode by using hand gesture recognition techniques, we can control the music player. With the help of Image Processing technique, processing is performed on the Captured image and the respective gesture is identified on the basis of the Convexity defects calculated. OpenCV platform helps in the implementation of the Convex Hull Algorithm.

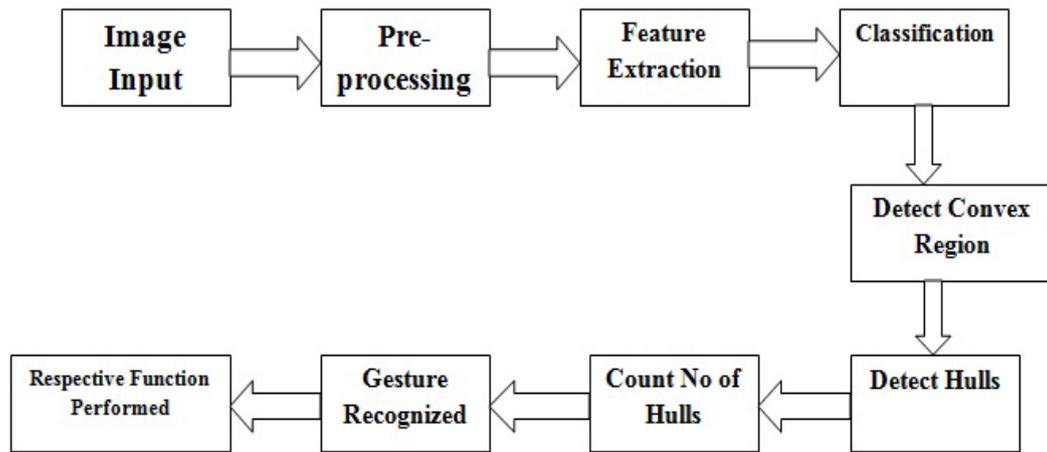


Fig.1 Block diagram of proposed system

First we will discuss about the algorithm which we have used for our gesture controlled music player:

A. Convex Hull Algorithm

The common form of this algorithm contains determination of the smallest convex set (called the “convex hull”) which contains some discrete set of points. There are various applications of this algorithm like shape analysis, collision avoidance and hidden object determination. The convex hull of any geometric object (such as a point set or a polygon) is the smallest convex set which contains that object. There are so many equivalent definitions for a convex set S . The most basic of these is: A set S is convex if whenever two points P and Q are inside S , then the whole line segment PQ is also in S .

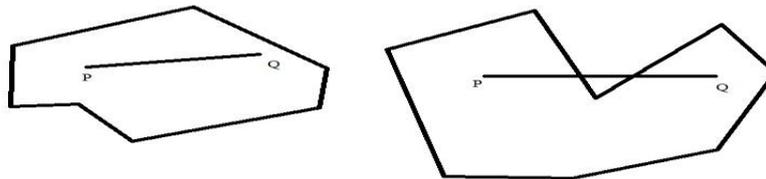


Fig.2 Convex and Non-convex Area

Convex hull is always drawn around the hand, in a way that all contour points are within the convex hull. This makes an envelope around the hand.

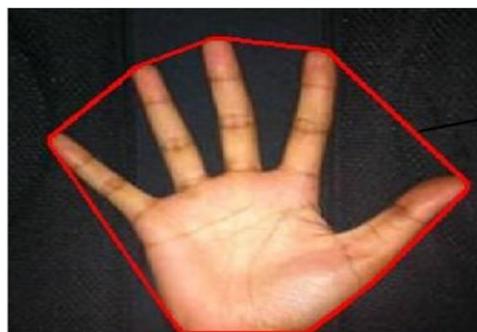


Fig.3 Image for convex hull

1) *Convexity Defects*: When the convex hull is drawn around the contour of the hand, it fits set of contour points of the hand within the hull. It uses minimum points to form the hull to include all contour points on the hull or inside the hull and it maintains the property of convexity. Because of this the formation of the defects in the convex hull with respect to the contour drawn on hand takes place. Wherever the contour of the object is away from the convex hull which is drawn around the same contour there is presence of defect. Convexity defect gives the set of values in form of defects for every defect in the hull. The start and end point of the line of the line of defect in convex hull is contained by the vector. All these points indicate indices of

the co-ordinate points of the contour. These points can be easily retrieved by using start and end indices of the defect formed from the contour vector. Convexity defect also includes index of the depth point in the contour and its depth value from the line.

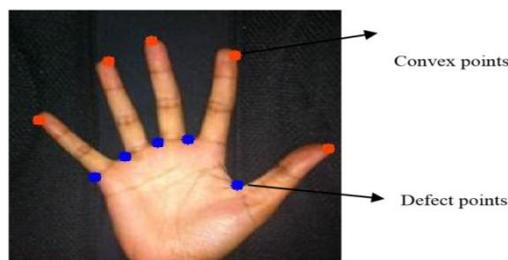


Fig.4 Convex points and Defects point

Now we will discuss about our music player which is controlled by hand gestures.

B. Music Player

This music player basically works on hand gestures technique. We are using Convex hull algorithm for hand detection and YCbCr algorithm for background subtraction. In this Music player we are giving five basic functions like play, next, previous, repeat and stop. For each functions we have given unique hand gestures.

Following are the functions of our music player:

1) *Play*: This function is used for turning on the music. For this function we have given the gesture as finger one. In this gesture there is no convexity defect. The fig.4 specifies the PLAY function.



Fig 5 Play function for Music Player

2) *Next*: This function is used for playing next song in music player. For this function we have given the gesture as two fingers. In this gesture only one convexity defect is present which is denoted by the green circle in the Fig.5.



Fig.6 Next function for Music Player

3) *Repeat* : This function is used for repeating a particular song in the music player. In this we are giving two operations related to the Repeat function ie. Repeat On and Repeat Off. When the Repeat On operation is performed by the user then the particular song is repeated infinite times. When the Repeat Off is performed by the user then the particular song is repeated for only single time and next song is played after that song automatically. For this Repeat function we are using gesture as three fingers. In this gesture two convexity defects are present which are denoted by green circle in the fig.6.



Fig.7 Repeat function for the Music Player

4) *Previous*: This function is used for playing the previous song in the music player. For this function we have given the gesture as four fingers. In this gesture three convexity defects are present which are denoted by the green circles in the Fig.7.



Fig.8 Previous function for the Music Player

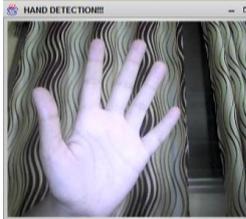
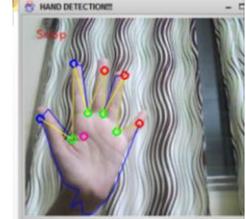
5) *Stop*: This function is used for stopping the song in the music player. For this function we have given the gesture as five fingers. In this gesture four convexity defects are present which are denoted by the green circles in the Fig.8.



Fig.9 Stop function for the Music Player

III. RESULTS

We tested this Music Player in three different light conditions i.e. Dark light, Bright light and Ambient light.

Parameters	Light conditions		
	Dark Light	Bright Light	Ambient Light
Snapshots			
Detection of skin	Partially Detected	Not Detected	Detected
Detection of Convexity Defects	Not Detected	Not Detected	Detected
Noise Reduction	Possible	Possible	Possible

I- Table showing music player in 3 different light conditions.

The distance of hand from camera also matters while running the music player. The distance of the hand from the camera should be maximum 1.5 meters. The detection of gestures became very easy with the camera of higher focal length.

IV. CONCLUSION

This paper presents system which is a real-time music player which is controlled by gestures made by human hand. The hand skin color and the light condition will be combined to degrade the detection results, which could be improved by machine learning or machine training. The hand placement parameter requires hand orientation detection after shape detection.

V. FUTURE WORK

Since in current designed music player lighting conditions affect the recognition of the gestures provided, to overcome this inefficiency we can use different algorithms for recognition of the gestures like Kinet algorithm, Canny Edge Detection Algorithm and also skin detection algorithm in HSV color model.

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