HAND GESTURE CONTROLLED DIGITAL MUSIC PLAYER USING ENHANCED IMAGE PROCESSING TECHNIQUES

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***Abstract*- The vision-based technology of hand gesture recognition is an important part of Human-Computer Interaction (HCI). Gesture controlled music player enables us to operate a digital music player by hand gestures with the help of image processing technology. The operations of music player such as play/pause, volume up, volume down, forward and rewind can be controlled by showing a specific gesture in front of the camera. The proposed system will give us the luxury to operate a music player using specific gestures without any physical device such as remote control. A Gesture image is captured with the help of camera and the image is recognized by performing various image processing techniques through MATLAB. The human hand gestures are recognized and a signal for each gesture is sent to the microcontroller (ARDUINO) in the form of labels. The music player which is interfaced with the microcontroller (ARDUINO) through relay driver will perform operations based on the gesture shown.**

***Keywords*: gesture recognition, image processing, MATLAB, digital music player**

I.INTRODUCTION:

Gesture recognition is one of the gateway for making the machine to understand human body language, thus building a richer bridge between machines and humans than the conventional user interfaces or even GUIs (graphical user interfaces). The hand gesture can be defined as a gesture or a posture which resulted from the movement of a combination of hand and arm. Although hand gesture and hand posture has a similar meaning in daily life, there are some differences. Hand gesture means a dynamic movement such as sign languages and waving hands which is complex but suitable for a real time environment.

Hand gesture recognition can be classified in to two major sub-divisions. One is non-vision based recognition by using tools such as data gloves, wrist bands etc. and another is vision based recognition. In this paper, we are concerned with vision based recognition of hand gestures. The input taken from camera is subjected to undergo various MATLAB algorithms which pre-process the image and helps to recognise a specific hand gesture. The signals for each hand gesture are sent to Arduino which compares the incoming signal with the database in real-time and produces an output if the incoming signal matches with the database. This output is fed to the music player via relay board and the player will operate based on the input gesture image.

II. LITERATURE SURVEY:

Hand gesture recognition systems are mainly created to develop an environment where man-machine interactions can be done efficiently with much ease. Many researchers have been carried out and lots of works have been done in this field by various researchers. There are many approaches that were followed peculiarly by different researchers like vision based, data glove based, Artificial Neural Network, Fuzzy Logic, Genetic Algorithm, Hidden Markov Model, Support Vector Machine and Vision based approaches for identifying hand gestures. Researchers classified gesture recognition in to three major steps; they are extraction, features estimation, and classification or recognition.

Yu used YCbCr color model to Distinguish skin colored pixels from the background. The required portion of the hand was extracted using this color model and filtered using median filter and smoothing filter. The edges were detected and features such as hand perimeter, aspect ratio, hand area are extracted. Accuracy of this approach was found to be 97.4%.

Raheja scanned the skin filtered image in all direction to find out the edges of the fingers. Then the edge tips were assigned with highest pixel value and thereby fingertips were detected

Some researchers have used skin-color histograms to perform segmentation process for hand gesture recognition. But it did not yield the desired results

III.PROPOSED SYSTEM

The block diagram of the proposed system is given in figure 1.1.

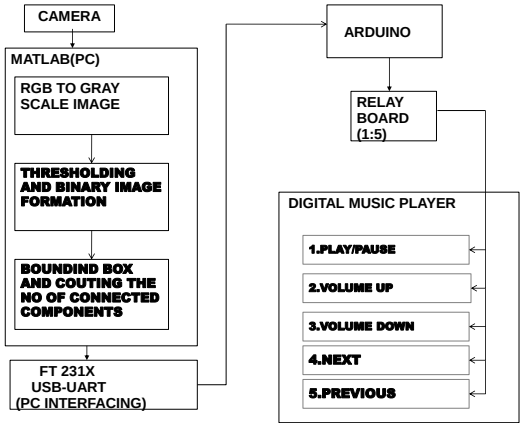

Figure 1.1 block diagram of hand gesture controlled digital music player

- **IMAGE ACQUISITION**

Camera is used for image acquisition purpose. The camera is connected to the computer using the USB port of the system. The real time video input is captured by the camera and MATLAB takes frames from the input video at a fixed rate. These image frames are the input images for processing and operating music player.

The obtained RGB image is then converted in to gray scale image which has intensity values between [0, 1].This process of converting RGB image in to gray scale image can be done by keeping the luminance and neglecting the Hue and saturation parameters of the image

The intensity values in gray scale image are mapped to new values so that the resultant image is an enhanced version of the gray scale image. This also increases the contrast of the output image

- **BINARY IMAGE FORMATION & MORPHOLOGICAL OPERATIONS**

The Obtained RGB image is converted in to binary image with the help of Otsu's method. Otsu method minimizes the intra class variance of the black and white pixels by choosing a specific threshold value. Thus it converts the grayscale image in to a binary image with the help of a threshold value

Though the binary image contains only black and white colors, due to the presence of noise in the input image, the binary image contains unwanted white & black pores (dots). These unwanted errors are eliminated by performing morphological operations. Morphological operations such as dilation and erosion will help to retain the structure of the image by replacing each pixel in the image with the value of their neighboring pixels. Morphological image close and open is also performed to get a perfect binary image

- **BOUNDING BOX FORMATION AND FEATURE EXTRACTION**

The properties of image regions are found which gives the properties of each connected component (object) in connected component image. The properties of the image includes all the shape measurements I.E area, bounding box, centroid, filled image, image, pixel id list, pixel list and sub array id.

Bounding box is used here to crop the image and find the connected components in the newly bounded image. It returns the smallest rectangle containing the region, specified as a 1-by-Q*2 vector, where Q is the number of image dimensions. A rectangle bounding box is taken and the height of the rectangle is reduced as the image is further cropped to find the connected components in the cropped image

The image is cropped as per the properties specified in the bounding box. Then the no. of connected components is found out.

Connected components, returned a structure with four fields, they are connectivity, size of the image, number of connected components and number of connected objects in cell array

- **HARDWARE INTERFACING**

The values generated by the MATLAB have to be given to the Arduino for processing and controlling the relay board. The values from MATLAB software can be sent only through the system USB port. The USB port cannot be interfaced directly with Arduino UNO for this purpose FT 231X USB-UART is used. It does not require any additional power supply, the power from USB is sufficient for its operations. It receives the values from the System sent by the MATLAB and gives it to the Arduino UNO through TX and RX pins.

The Arduino Uno is a microcontroller board based on the ATmega8. The switches of the relay board are connected to the output pins of the Arduino board. It compares the received values from the MATLAB with the values specified to it in the program. If the values match it performs the specified operation. It opens the switches in the relay board connected to it by making the particular pin High. If the received value does not match any of the given values it remains idle.The relay switches open if it receives a high value to its relay pin and allows the current to flow through that switch. If a switch is opened current flow takes place therefore the particular button of the music player connected to it is made high and performs its specific function. Similarly the five switches of the relay board are connected to the five buttons of the digital music players.

IV) EXPERIMENT RESULTS

i) RGB TO GRAY IMAGE:

The input is taken in the form of RGB image which is then converted in to gray scale image

through proper techniques. The gray scale image is shown below infigure2.1

FIGURE 2.1 GRAY IMAGE

ii) ENHANCED IMAGE:

The intensity values in gray scale image are mapped to new values so that the resultant image is an enhanced version of the gray scale image. This process also increases the contrast of the output image and it is shown below in figure 2.2.

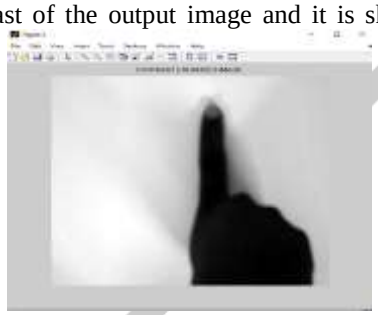

FIGURE2.2 CONTRAST ENHANCED IMAGE

iii) BINARY IMAGE

The non-zero imaginary part of the image is ignored to form the binary image is shown in figure 6.3.

FIGURE 2.3BINARY IMAGE

iv) PROPER INVERTED BINARY IMAGE ALONG WITH BOUNDING BOX

The binary image is inverted and operations such as dilation and corrosion are performed. The resultant image is known as proper binary image and it is shown below in figure 2.4

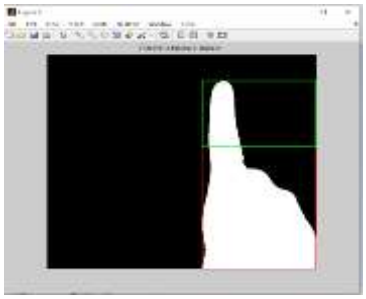

FIGURE.2.4 PROPER INVERTED BINARY IMAGE WITH BOUNDING BOX

v) CROPPED IMAGE:

The image is cropped after the bounding box formation. The cropped image is shown below in figure 2.5

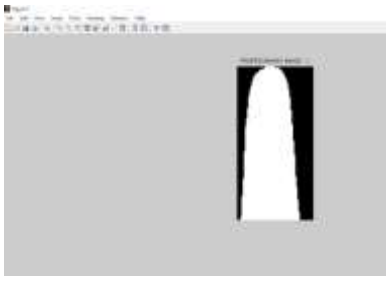

FIGURE2.5 CROPPED IMAGE

V CONCLUSION

The primary aim of the project is to operate a digital music player by hand gestures using enhanced image processing technique and thereby bringing there by bridging the effect of technology in to man's busy world. When a gesture is shown in front of the video camera the music player will perform the specific action assigned to it. Each operation of the music player predetermined by a unique gesture so that, if no gesture or a wrong gesture is shown, the system will reply with an error message indicating that the gesture input is invalid. Thus it is concluded that the music player can be successfully operated with much ease just by showing appropriate gestures.

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