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A Brief Study on Automatic Music Control System using Image Processing

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Abstract: *The scope of our project is to control a music player using human gestures. This employs a camera along with an embedded system to segment human gestures and convert them to control signals in real-time. With the help of the Music Controller, one can simply wave or do a simple gesture of hand movement in front of the webcam which will in turn switch or pause the particular music track that was being played. Our project mainly focuses on scenarios where we are multitasking that is working on many applications at a time or running various programs at a time on our desktop and along with that listening to music in background that is music being played in one of the windows. At such times if we wish to pause or switch a particular music track we have to make some movements like switching to the music window and doing the desired operation. With the help of Music Controller, one can simply wave or do a simple gesture of hand movement in front of the webcam which will in turn switch or pause the particular music track that was being played.*

Keywords: Image Processing.

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. Hand gesture means a dynamic movement such as sign languages and waving hands which is complex but suitable for a real time environment. Gesture-based technology has been booming the past several years, especially with the creation of the Microsoft Kinect for PCs and the Xbox 360. Computer-integrated programs can be something for the future, especially because it simplifies tasks such as changing a song while you're reading something important. Controlling music playback (e.g. play, stop, pause, and next) is often used to demonstrate new interfaces and inter- action techniques. Using a set of function to control music playback has also been used to demonstrate and evaluate gesture recognition algorithms. In order to derive meaningful conclusions from an evaluation of a gesture recognition algorithm it is, however, helpful to use a gesture set which is not purely based on the designer's intuition, the algorithms capabilities, or chance. Most work in the area of gestural interaction focused on algorithms and robust recognition of gestures. However, gestural interfaces must fulfill the same requirements as any other interaction technique. In particular, it is important to define usable gestures for the functionalities that the particular application offers. In order to deduce usable gestures a process that ensures valid results must be employed.

1.1 Objective

The main objective of this proposed system is,

- A 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.
- The proposed system mainly focuses on scenarios where we are multitasking that is working on many applications at a time or running various programs at a time on our desktop and along with that listening to music in background that is music being played in one of the windows. At such times if we wish to pause or switch a particular music track we have to make some movements like switching to the music window and doing the desired operation. This process is bit long and time consuming as well.
- Suppose if you can do this operation without switching to the media player and by doing just one hand

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movement, it will save some time and also keep you linked with the work you doing currently.

- With the help of Music Controller, one can simply wave or do a simple gesture of hand movement in front of the webcam which will in turn switch or pause the particular music track that was being played.

III. LITERATURE SURVEY

Real-Time Hand Gesture Detection and Recognition Using Bag-of-Features and Support Vector Machine Techniques- Nasser H. Dardas and Nicolas D. Georganas[1]

This paper include detecting and tracking bare hand in cluttered background using skin detection and hand posture contour comparison algorithm after face subtraction, recognizing hand gestures via bag-of-features and multiclass support vector machine (SVM) and building a grammar that generates gesture commands to control an application. Extracting the key points for every training image using the scale invariance feature transform (SIFT), A vector quantization technique will map key points from every training image into a unified dimensional histogram vector (bag- of-words) after K-means clustering. This histogram is treated as an input vector for a multiclass SVM to build the training classifier. In the testing stage, for every frame captured from a webcam, the hand is detected using some algorithm then, the key points are extracted for every small image that contains the detected hand gesture only and fed into the cluster model to map them into a bag-of-words vector, which is finally fed into the multiclass SVM training classifier to recognize the hand gesture.

A Prototype for 3-D Hand Tracking and Posture Estimation- Ayman El-Sawah, Nicolas D. Georganas, and Emil M. Petriu[2]

Explained about experience in designing a prototype for 3-D hand tracking and dynamic gesture recognition. Objective is able to continuously visually track the hand in a general background and to be able to recognize dynamic gestures in real time. The constraints and the conditions for this system is to justify approach are generic no restricted environment and generic nonspecific application. This paper prototype has undergone several stages from simulation to three different cycles of development and testing. It is also present a road map for future development to reach the final goal.

Real-time Sign Language Recognition based on Neural Network Architecture- Priyanka Mekala, Ying Gao, Jeffrey Fan and Asad Davari[3]

In this, architecture is being proposed using the neural networks identification and tracking to translate the sign language to a voice/text format. Introduction of Point of Interest (POI) and track point provides novelty and reduces the storage memory requirement. Training and generalizing are the most basic and important properties of the neural networks. The neural network architecture consists of three layers - an input layer, one hidden layer and an output layer. . In the gesture classification stage, a simple neural network model is developed for the recognition of gestures signs using the features computed from the video captured. The system is designed to recognize simple gestures or signs. The design is very simple and does not require any kind of gloves to be worn. Also the system is applicable to different backgrounds.

Indian Sign Language Recognition Using Eigen Value Weighted Euclidean Distance Based Classification Technique- Joyeeta Singha and Karen Das[4]

This project explained system using Eigen value weighted Euclidean distance as a classification technique for recognition of various Sign Languages of India. Eigen values and Eigen vectors are a part of linear transformations. Eigen vectors are the directions along which the linear transformation acts by stretching, compressing or flipping and Eigen values gives the factor by which the compression or stretching occurs. The system comprises of four parts: Skin Filtering, Hand Cropping, Feature Extraction and Classification. It recognize the various alphabets of Indian Sign Language for Human Computer interaction giving more accurate results at least possible time. It will not only benefit the deaf and dumb people of India but also could be used in various applications in the technology field. This project include 24 alphabets of Indian sign language, each with 10 samples thus a total of 240 images captured by camera.

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Gabor filter-based hand-pose angle estimation for hand gesture recognition under varying illumination- Deng-Yuan Huang, Wu-Chih Hu, Sung-Hsiang Chang[5]
This project illustrate the hand gesture recognition based on Gabor filters and support vector machine (SVM) classifiers for environments with varying illumination. The proposed method is robust against varying illumination, which is achieved using an adaptive skin- color model switching method is insensitive to hand- pose variations, which is achieved using a Gabor filter- based gesture angle estimation and correction method allows users to wear either a long- or short-sleeve shirt,which is achieved using a method that segments the hand from the forearm. They used Hand-pose angle estimation and correction, Hand- region segmentation from the forearm algorithm.

Vision-Based Interpretation of Hand Gestures for Remote Control of a Computer Mouse- Antonis A. Argyros and Manolis I.A. Lourakis[6]
This paper presents a vision-based interface for controlling a computer mouse via 2D and 3D hand gestures. The proposed interface builds upon our previous work that permits the detection and tracking of multiple hands that can move freely in the field of view of a potentially moving camera system. Dependable hand tracking, combined with fingertip detection, facilitates the definition of simple and, therefore, robustly interpretable vocabularies of hand gestures that are subsequently used to enable a human operator convey control information to a computer system. Two such vocabularies are defined, implemented and validated. The first one depends only on 2D hand tracking results while the second also makes use of 3D information. As confirmed by several experiments, this interface achieves accurate mouse positioning, smooth cursor movement and reliable recognition of gestures activating button events.

Static Hand Gesture Recognition using Mixture of Features and SVM Classifier- Dipak Kumar Ghosh and Samit Ari[7]
This explained a vision-based system for recognition of static hand gesture. It deals with images of bare hands, and allows to recognize gesture in illumination, rotation, position and size variation of gesture images. The proposed system consists of three phases: preprocessing, feature extraction and classification. The preprocessing phase involves image enhancement, segmentation, rotation and filtering process. To obtain a rotation invariant gesture image, a novel technique is proposed in this paper by coinciding the 1st principal component of the segmented hand gestures with vertical axes. In feature extraction phase, this work extracts localized contour sequences (LCS) and block based features and proposes a novel mixture of features (or combined features) for better representation of static hand gesture. The combined features are applied as input to multiclass support vector machine (SVM) classifier to recognize static hand gesture.

Hand Gesture Based Remote Control System Using Infrared Sensors and a Camera-Fatih Erden and A. Enis Çetin[8]
In this paper, a multimodal hand gesture detection and recognition system using differential Pyro electric Infrared (PIR) sensors and a regular camera is described. Any movement within the viewing range of the differential PIR sensors are first detected by the sensors and then checked if it is due to a hand gesture or not by video analysis. If the movement is due to a hand, one- dimensional continuous-time signals extracted from the PIR sensors are used to classify/recognize the hand movements in real-time. Classification of different hand gestures by using the differential PIR sensors is carried out by a new winner-take all (WTA) hash based recognition method. Jaccard distance is used to compare the WTA hash codes extracted from 1-D differential infrared sensor signals. Classification of the hand gestures by the PIR sensor array is carried out by a new winner-take-all (WTA) hash based method. This multimodal solution to the hand gesture detection and recognition problem is a good alternative to the existing methods because of its accuracy, low cost and low power consumption. Algorithm used by this approach is WTA hash algorithm.

Static and Dynamic Hand Gesture Recognition in Depth Data Using Dynamic Time Warping- Guillaume Plouffe and Ana-Maria Cretu[9]
This paper discusses the development of a natural gesture user interface that tracks and recognizes in real time hand gestures based on depth data collected by a Kinect sensor. The interest space corresponding to the hands is first segmented based on the assumption that the hand of the user is the closest object in the scene to the camera.
A novel algorithm is proposed to improve the scanning time in order to identify the first pixel on the hand contour within this space. Starting from this pixel, a directional search algorithm allows for the identification of the entire hand contour.

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The k-curvature algorithm is then employed to locate the fingertips over the contour, and dynamic time warping is used to select gesture candidates and also to recognize gestures by comparing an observed gesture with a series of prerecorded reference gestures. The comparison of results with state- of-the-art approaches shows that the proposed system outperforms most of the solutions for the static recognition of sign digits and is similar in terms of performance for the static and dynamic recognition of popular signs and for the sign language alphabet. The solution simultaneously deals with static and dynamic gestures as well as with multiple hands within the interest space.

Hand region extraction and Gesture recognition from video stream with complex background through entropy analysis- JongShill Lee, YoungJoo Lee,EungHyuk Lee and SeungHong Hong[10]
The hand gesture recognition utilizing image processing relies upon recognition through markers or hand extraction by colors, therefore it is heavily restricted by the colors of clothes or skin. In this paper, they propose a method to recognize hand gestures extracted from images with complex background for more natural interface in HCI (Human Computer Interaction). The proposed method is obtaining the image through subtract one image from another sequential image, measuring the entropy, separating hand region from images, tracking the hand region and recognizing hand gestures. Through entropy measurement, they got color information that have near distribution in complexion for region that havebig value and extracted hand region from input images. We could draw hand region adaptively in change of lighting or individual's difference because entropy offer color information as well as motion information at the same time. Detected contour using chain code for hand region that is extracted, and present centroidal profile method that is improved little more and recognized gesture of hand.

III. EXPECTED OUTPUT

Firstly, the webcam will capture the image of the gesture by the user. This image will then go through various stages of background subtraction. Then the image will be sent to the database in which the predefined gestures are stored. In the database the gesture recognition will play its part and number of functions will be counted. Along with the counting of fingers, orientation detection will take place and the actual gesture will be sent for matching.
Once the gesture processed gesture is received, the pattern matching algorithm will carry out its function to find the match by finding the pattern which is predefined in the database. When the match is found, the report will be sent to the database which in turn will report to the system.
The system will then carry out the task as specified in the database for that particular gesture. Once the action is performed, the task loop of the application is over and it is set to receive the next gesture and perform the task required by the user.

IV. 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.

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