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VOLUME CONTROL USING HAND GESTURES

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Abstract: In this project we are building a "Perceptual User Interface (PUI)" for user to adjust the volume of Personal Computer. We are going to leverage Gesture recognition technique to capture the user actions and modulate the computer volume. We will be leveraging Python and OpenCV open-source libraries to build this interface. A technique called hand gesture recognition can spot a hand motion in a live video feed. One of the more challenging tasks is designing the ability to recognize hand gestures since it combines two important problems. The initial stage is to recognize the hand, followed by the creation of a sign that can only be used by one hand at a time. Several contexts, such as sign language and human-computer interaction, are appropriate for its use. Utilizing Python and OpenCV, hand gesture recognition may be built using the fundamentals of hand segmentation and the hand detection system, both of which employ the Haar-cascade classifier. Using shape-based feature detection, this research discusses a method for identifying hand gestures. A single camera is used in the arrangement to record and send the user's gesture to the system.

***Keywords*:** Gesture recognition, Human-machine Interaction (HMI), Perceptual User Interface (PUI), Structuring of elements.

1.INTRODUCTION

Any non-verbal communication that aims to convey a certain message can be referred to as a gesture. A gesture is any bodily action, big or tiny, that a motion sensor can recognize in the context of gesture recognition. To control computers and other electronic appliances, gesture recognition is a process that identifies the movements or postures of various human body parts. The rapidly expanding area of image processing and artificial technology is gesture recognition.

Gesture recognition, along with facial recognition, voice recognition, eye tracking and lip movement recognition are components of what is refer to as a perceptual user interface (PUI). A perceptual UI is a point of interaction that would permit a PC framework to see, grasp, and respond satisfactorily to the looks, talking, signals or movements, and other perceptually-based patterns of correspondence normal to clients. The ability of gesture recognition to establish an easy channel of communication between humans and computers, or HCI, is the main driver of the field's growth (Human Computer Interaction).

2. LITERATURE SURVEY

In this paper, Viraj Shinde etc claimed that the mentioned work will aid in the full eradication of tradition. To capture input images, simply a webcam is needed. By eliminating the necessity for direct physical touch with the gadget, this would bring about a new age of human-computer connection. By employing gesture commands, the technology makes it simple for anybody to use a computer. [1].

In this paper, Mohamed Mansoor Roomi etc created the control of the PowerPoint program is suggested using a hand gesture-based recognition system. By using a Gaussian Mixture Model, the suggested technique extracts the foreground. The retrieved item is put through the Star Skeletonization method to find the extreme points. The experimentation is tried on several datasets, which supports the conclusion that the proposed solution outperforms the previous approaches since it is robust to scale variation and does not require any predetermined templates for recognition. [2].

In this article, Sk.Abdul Soniya and others stated that the project displayed a program that allowed users to easily operate software with hand gestures. a vision-based hand gesture system that can run in real-time on an affordable PC with cameras without the need for special markers or gloves. The technology can monitor the locations of the index finger and counter tips on each hand. A desktop-based volume control system, in which a user may adjust volume and cursor navigation in real-time using natural hand motions, served as the inspiration for this hand gesture. [3].

In this article, Martendra Pratap Singh and other proved that the application being shown in this project enables hand gestures as a practical and simple means of software control. A gesture-based volume controller doesn't need any special markers, and it can be used in real life on basic PCs with inexpensive cameras as it doesn't need those to recognize or record the hand movements to be of extremely high clarity. [4].

In this paper, Sagar Bounsley R, Tanuja JC expressed that this article outlines a concept that can be used to regulate the system's audio level using hand gestures. The suggested approach here effectively created a hand gesture volume control that can be adjusted from maximum to minimum using a person's gesture and perform the corresponding functions accurately. [5].

2.1 PROBLEM STATEMENT

We are going to suggest a new approach called "Volume Control Using Hand Gestures" because both models namely hand gestures recognition by using hidden Markov model and robust part-based hand gesture recognition using Kinect sensor are difficult to use on simple PCs. So, to overcome this complication we are going to utilize OpenCV and Python libraries in our system, both of which are simple to install on low-end PCs.

3. PROPOSED SYSTEM

An open-source library for computer vision, image processing, and machine learning is called OpenCV Python. Using it, one may analyse pictures and movies to find faces, objects, and even human handwriting. Multidimensional array objects and a collection of functions for manipulating them may be found in the NumPy library. Pycaw is a library used for audio control. We have access to a few popular math functions and constants in Python thanks to the Python Math Library. Ctypes is a foreign function library in python. It offers C-compatible data types and permits invoking DLL or shared library functions. This cross-platform framework supports multiple platforms, including desktop/server, Android, iOS, and embedded devices like the Raspberry Pi and Jetson Nano.

The difficulty with these systems is the background image or video displayed while the input is being recorded can also have a lightning effect on the quality of your input, causing problems with recognizing gestures.

Advantages Of Proposed System:

i. Easy to use
ii. Hassle free
iii. More interactive

3.1 SYSTEM ARCHITECTURE

It is represented in the Fig 1 below the step-by-step work done by the system in a flow type starting from taking a video sequence as input.

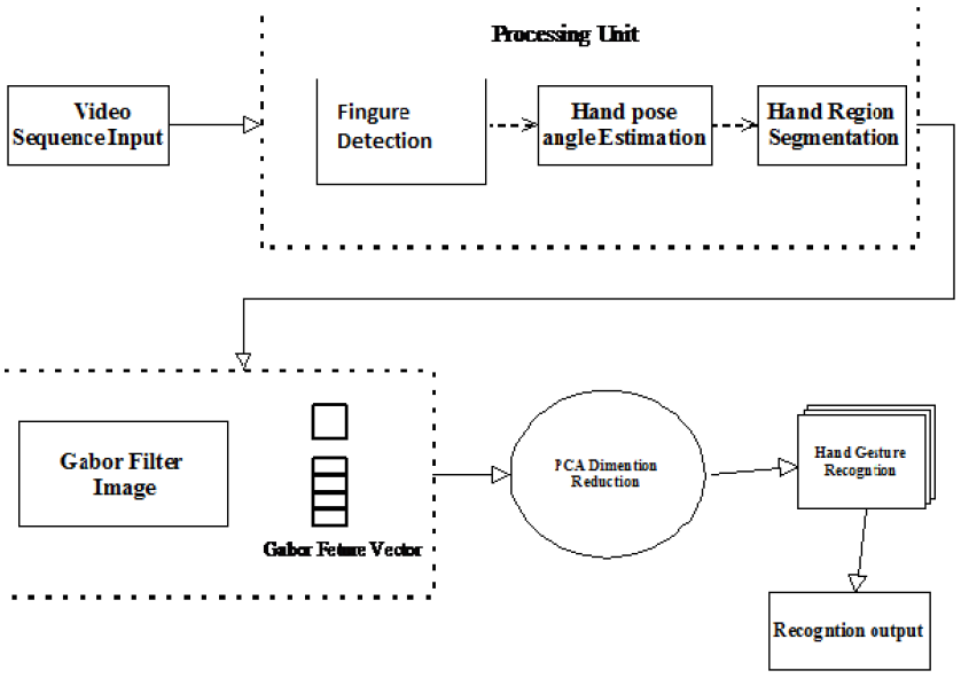

Fig 1. System Architecture

3.2 METHODOLOGY USED:

a) Detect hand landmarks.
b) Calculate the distance between thumb tip and index finger tip.
c) Map the distance of thumb tip and index finger tip with volume range. For my case, distance between thumb tip and index finger tip was within the range of 30 – 350 and the volume range was from -63.5 – 0.0.
d) In order to exit press “q”.

3.3 IMPLEMENTATION PROCEDURE:

i. It may be accomplished utilizing the command prompt in addition to python IDLE, an IDE software interpreter.
ii. Import the open CV Library into the Python code, which is being used to read the picture, which in this case is only a hand. The next step is to develop multimodal applied machine learning pipelines using the cross-platform Mediapipe framework. It serves as a tool for detection. Euclidean norm is returned by the procedure hypot(). The length from the origin to the specified coordinates is known as the Euclidean norm.
iii. Then, using Pycaw, we utilized the basic library ctypes and audio utilities to obtain the default audio device. If the video camera is open, the device used to capture video will do so. A high-fidelity hand and finger tracking system is Media Pipe Hands. If hands are found, we have used the audio utility feature to sketch the hand’s contour as seen below.
iv. Use Pycaw to get the default audio device. We then discovered the range, which is from 0 to 100, read the frames from the camera, and convert the picture to RGB.
v. With the aid of the “hands.process()” method, we can identify hands in the frame if Fit List of lm or glm Objects with a Common Model is null. Once the hands are located, we will identify the key points. We then use cv2.circle to highlight the dots within the key points and mpDraw.draw landmarks to link the important spots. Then we print using the tips of our index and middle fingers (x1, y1, x2, y2). After that, we print the fingers after determining which fingers are up. Coordinate conversion is followed by value smoothing.
vi. If the index and middle fingers are both near together, we lower the volume. If they are apart, we raise the level. The length of the line passing through the locations is then determined.
vii. Map the distance between the index finger and thumb tips using the volume range. In our situation, the distance between the tips of the thumb and index finger fell between 15 and 220, and the volume fell between -63.5 and 0.0. Let us say that in this instance, the maximum volume is set at -8.0 to 194.83366, and readings for other volumes are obtained in a similar manner.

4. RESULTS:

The following are the results for the volume ranges at its maximum and minimum levels using hand gestures.

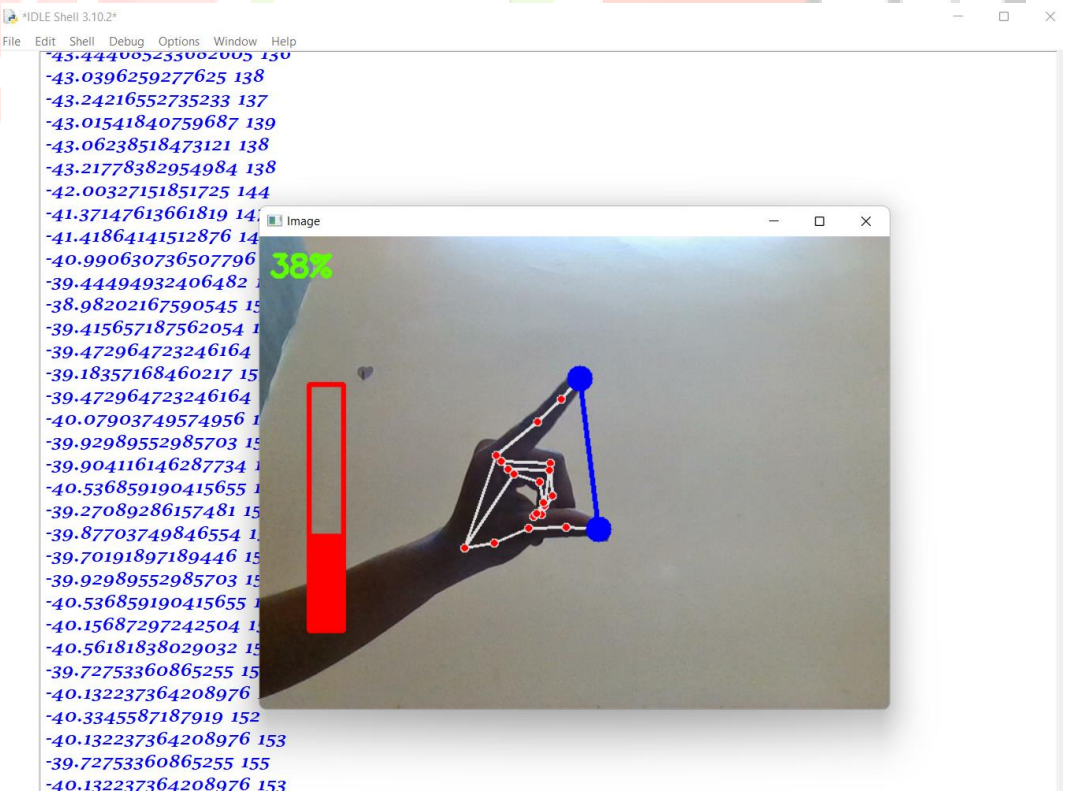

Fig-1.1: volume at its minimum level

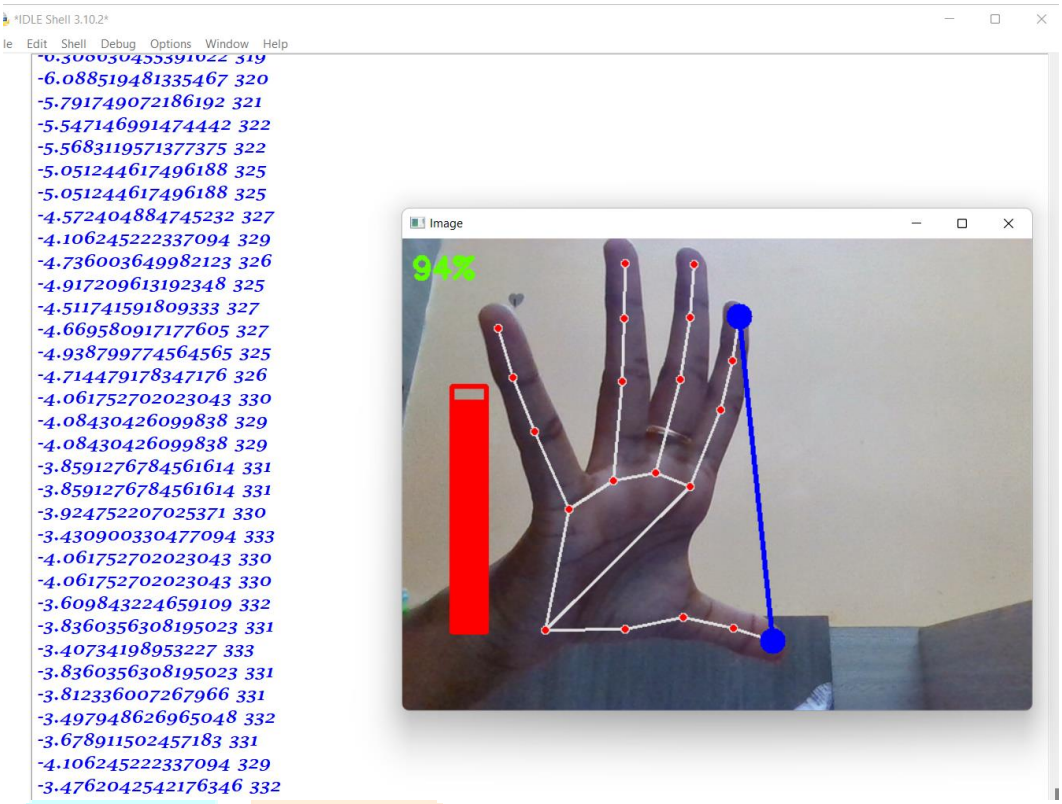

Fig.1.2: volume at its maximam level

5. CONCLUSION

The application currently presented in this project enables hand gestures as a practical and simple approach of software control. A gesture-based volume controller does not need any special markers, and it can be used in real life on basic PCs with inexpensive cameras. Since it doesn't need high-definition camera to recognize or record the hand movements to be of extremely high clarity. This would usher in a new era of computer-human interaction where no direct physical contact is required. The system makes it simple for anyone to use a computer by employing gesture commands. It employs a variety of algorithms and techniques, such as tracing important spots in the photos and calculating the distance between locations. The technology can monitor the locations of each hand's index finger and counter tops in particular. It is a quick and easy method for managing sound equipment that requires little manual work. It can run in real-time on a common PC with inexpensive cameras and does not need special gloves or markers.

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