IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Volume and Brightness Control with Hand Gestures A Computer Vision Approach

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Abstract : Gesture Recognition has become increasingly relevant in the field of human-computer interaction, as it is a natural way to convey information. We aim to create a system that can identify specific human gestures and utilize them to transmit information for device control. This enables users to operate a computer by performing a specific gesture in front of the camera. The below approach can detect multiple hands simultaneously, that is left and right, each having its own purpose. It is detected by a standard webcam, and requires no extra equipment. The left hand is responsible in controlling the brightness and the right hand will be responsible for controlling the volume. Here we have used different computer vision techniques which includes border detection, and convex-hull detection. The system was able to detect the distance between two points present in the hand, namely fingertip of thumb as well as index finger. Then it calculates the distance between them which is used to apply for volume and brightness, i.e. If the fingers are pinched, the distance between them becomes "zero", thereby setting the volume or brightness to zero. If it has the maximum distance ,then the volume or brightness is set to maximum that is "100".The Volume or brightness is decided based upon the hand. The primary aim here is to enable users to adjust the volume as well as the brightness of their system with ease, either by increasing or decreasing it. This offers a promising alternative to touch-based controls as well as voice-based controls.

Index Terms **- Hand Gesture, Volume Control , Brightness Control, Human Control Interaction, Edge Detection, OpenCV, Computer Vision**

I.INTRODUCTION

Hand gestures act as a potent communication medium for Human-Computer Interaction , surpassing traditional input devices like keyboards, mice, joysticks, and touchscreens. It also acts as an easier way ,since it doesn't require learning of any new skill. The proposed system includes a desktop or a laptop interface, allowing users to interact with computers through hand gestures. There are many ways in which user can interact it can be either by data gloves or utilize web cameras or separate cameras to record their hand gestures.

Building a hand tracking system is the first and most essential step in creating any hand gesture recognition system. Because it acts as the sole purpose and a building block behind the entire system. For Data Glove-based methods, sensor devices are typically used to capture hand and finger motions as multi-parametric data. Additionally, other sensors are employed to gather information about hand configuration and movement. When this particular method is used, we require extra equipment. To eliminate extra equipment, we have preferred using the method which requires less equipment. In our project we require only a webcam. Recognizing hand gestures can be challenging due to the background images or videos captured during user input, as well as variations in lighting that affect the quality of the input. The process of identifying a connected region in an image that meets certain criteria, such as colour and pixel relationships, is called segmentation. To accomplish this, several important packages like OpenCV-Python, NumPy, Media pipe are utilized.

Hand gesture recognition involves multiple levels of processing, such as image acquisition, pre-processing, feature extraction, and gesture identification. The initial step is to capture video frames using a webcam. The collected images undergo pre-processing, which includes colon filtering and smoothing. Feature extraction techniques are applied to extract pertinent information from the hand images, such as hand outlines. Gesture recognition techniques are then utilized to recognize specific hand gestures.

The development of a hand gesture recognition system is challenging due to two primary issues, the first of which is detecting a person's hand. In our case, it is important to detect which hand, since the function is different for each hand. Hen left hand is

detected, the brightness is changed, and when right hand is detected, the volume is changed. Later the points which are predefined are detected based upon the hand detected.

Many people rely heavily on their computer skills, which typically involve using a large keyboard and mouse. However, extended computer use can lead to various health issues. Using hand gestures as an input method provides an attractive alternative for human-computer interaction, as it is a natural way of communication that does not negatively impact one's health like using a keyboard and mouse can. Hand gestures can convey actions, feelings, and thoughts, and users often use touch gestures to express their emotions and ideas. Gesture recognition technology enables computers to interpret and respond to human body language, creating a more sophisticated interaction between humans and machines beyond traditional text or graphical user interfaces. This particular project utilizes computer vision to capture and interpret human hand gestures, which are then used as input to control various applications. The primary goal of this project is to develop an interface that can dynamically capture and recognize hand gestures, specifically for controlling the volume level and the brightness level.

II.REVIEW OF LITERATURE

[1] The system is proposed to detect English numbers from 0-9 with the use of flexible hand gestures. The system has two steps .The first step is pre-processing and the next step is the partitioning step. Since touch is of two types Touch gestures and touch links. A key touch is used to detect the link touch of a continuous touch. The method between the two points of continuous touch is given separately. The Discrete Hidden Markov Model is used for classification. This DHMM is trained by the Baum-Welch algorithm. The average HMM recognition rates range from 93.84% to 97.34%.

[2] Inexpensive depth camera - The Kinect sensor is used to create a hand-sensitive touch recognition of the solid part, in this paper. Since the kinect sensors have a low resolution it is difficult to identify the hand, but they can easily capture large objects. In order to deal with the sensory hand-held sensors, the authors proposed a novel grade matrix known as the Finger Earth Movers range. Only the fingers are associated with FEMD but not the whole hand. Noisy hand conditions are treated better, as 0FEMD can distinguish hand gestures with minimal difference. The system works effectively and efficiently in uncontrolled environments. 93.2% accuracy is achieved by a test result.

[3] The target paper aims to integrate the various existing methods of the Deaf Communication Translator System. Two broad categories of communication methods used by deaf people - these are - the Wearing Communication Device and the Internet Learning Program. Below the Wear Lock connection system, there is a Glove based system, keypad mode and Handicom Touch-screen. All three of the above methods use different sensors, an accelerometer, a small controller, a text-to-speech module, a keypad and a touch screen. The need for an external tool to translate the message between deaf and non-deaf people can be overcome by a second approach, namely an online learning program. The Online Learning System has different approaches. Five different modes are the SLIM module, TESSA, Wi-See Technology, SWI_PELE System and Web-Sign Technology.

[4] Since there are various hand gestures and enriched information contained in them, recognition of hand gesture has been greatly used in many fields, such as UAV, somatosensory game, sign language recognition and so on.

[5] Currently, the algorithm for hand gesture tracking which is applied widely includes meanshift Kalman filtering and optical flow algorithm and so on.

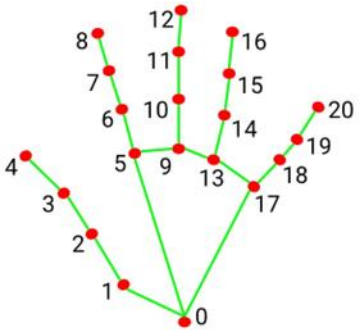
III.SYSTEM ARCHITECTURE AND METHODOLOGY

This system requires very less equipment. It requires basic devices like a webcam, PyCharm software , and few packages installed in it. The GUI processes the gestures captured and translates them into specific actions. By recognizing these gestures, the user can control the system's volume and brightness as the final output.

Initially we need to import necessary modules for recognition. The program then captures the area of interest by detecting various hand landmarks. After getting the hand land marks, it verifies the distance between the thumb and index figure tip. By using points 4 and 8 on the hand, the distance is determined, and the volume of the device is adjusted proportionally. Ultimately it set according to the distance. In order to set the volume or brightness, we press the ‘q’ key.

Discussing about modules and packages, Python technology is utilized to develop this project, with the help of OpenCV and NumPy modules. The necessary libraries are imported to process the input and output. The libraries used in this project that require importing include OpenCV, media pipe, math, ctype , pycaw, and NumPy. For detecting the video input from the camera and recognizing gestures, this project utilizes the media pipe library, To access the speaker, the pycaw library is employed, and a range of volume is provided, from the minimum to maximum volume. The NumPy module is an essential component of Python that is mainly used for numerical computations. It provides various functions such as multiply, divide, power, etc. OpenCV is a Python library that employs machine learning to detect faces, and supports multiple programming languages. Besides face detection, it can perform object and motion detection as well.

The volume control in this project is based on the shape of the user's hand. The system captures the input by detecting the object and subsequently performs hand gesture recognition to determine the appropriate volume level.



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

Fig. 1 The points predefined for the hand to recognize the hand gesture.

IV.IMPLEMENTATION

The program here is implemented with the help of PyCharm IDE software, also it can be implemented using the command prompt. To perform hand gesture recognition, the OpenCV library is imported into the Python project to read the image of the hand. Then, Media Pipe is used for detection purposes. The hypot() method is used to calculate the Euclidean norm and obtain the distance between the fingertips. The Pycaw library is used to get the default audio device, and comtypes is used for audio utilities.

The video capture object is used to capture information from the video camera. MediaPipe Hands is then used for high-fidelity hand and finger tracking. If hands are detected, the following hand outline is drawn using the audio utility function. After obtaining the default audio device using Pycaw, we interface with the required volume and find the range from 0 to 100.

The frames are then read from the webcam and converted to RGB. Once the hands are detected, we locate the key points and highlight the dots using cv2.circle. The tips of the index and thumb fingers are then printed.

If both the index and thumb fingers are close, we reduce the volume or brightness. Conversely, if the index and thumb finger are away, we increase the volume or brightness. As discussed earlier the volume or brightness depends on the hand.

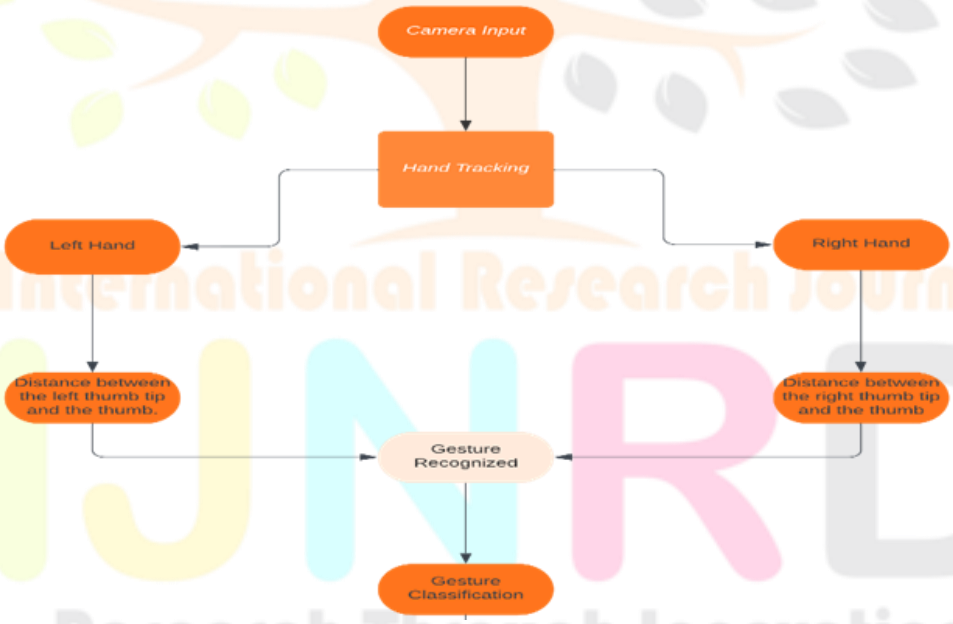


Fig. 2 Step by Step Representation

V.RESULT

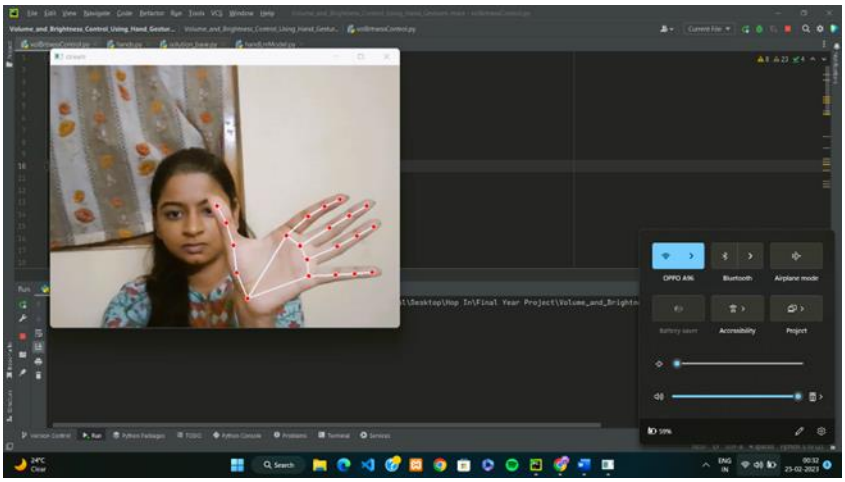


Fig. 3 The above hand is Right Hand, hence volume will be controlled.
Since the distance between the 4 and 8 point is maximum, we have the volume set to its maximum length

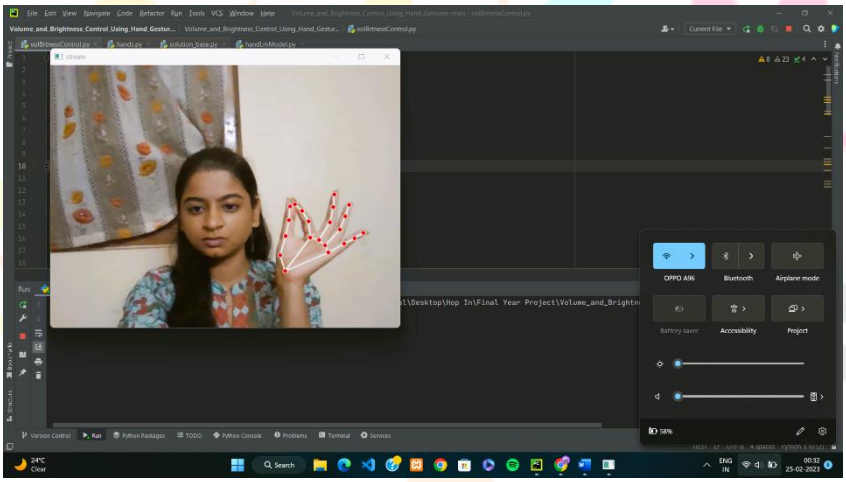


Fig. 4 The above hand is Right Hand, hence volume will be controlled.
Since the distance between the 4 and 8 point is minimum, we have the volume set to its minimum length

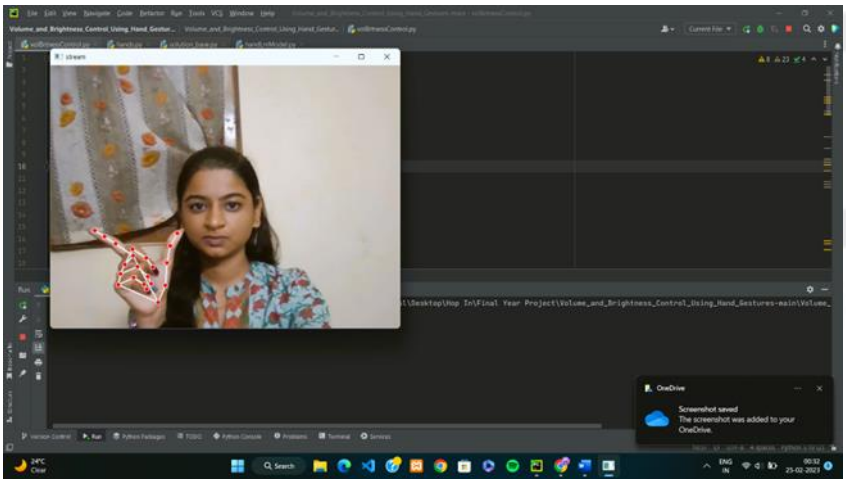


Fig. 5 The above hand is Left Hand, hence brightness will be controlled.
Since the distance between the 4 and 8 point is maximum, we have the Brightness set to its maximum capacity

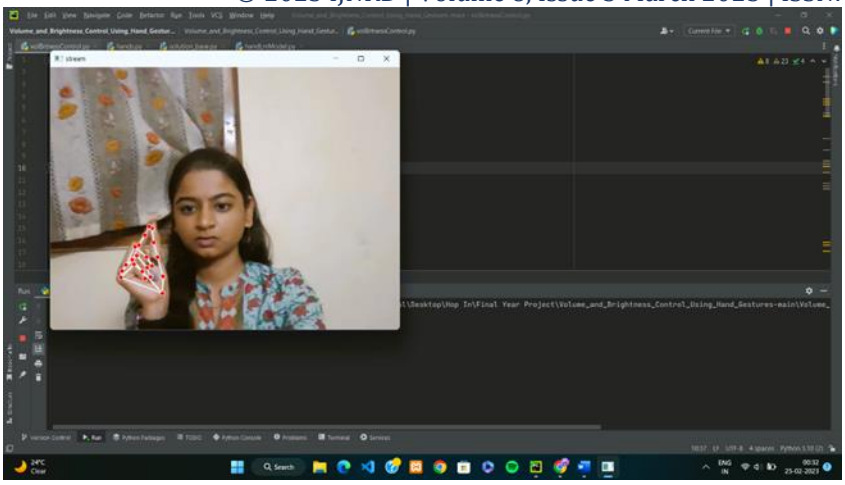


Fig. 6 The above hand is Left Hand, hence brightness will be controlled.
Since the distance between the 4 and 8 point is minimum, we have the Brightness set to its minimum capacity

VI.CONCLUSION

This project introduces a hand gesture based system for convenient and easy control of software, particularly a gesture-based volume and brightness controller that does not require specific markers and can be operated using low-cost cameras. The system tracks the tip positions of the thumb and index finger of each hand, enabling automation and easier control of the system. The implementation is based on OpenCV library of python, utilizing various algorithms and methods such as image point tracing and distance calculation between points. The system is efficient, simple, and does not require special markers or gloves.

The main objective of this project is to develop a real-time gesture volume control system that allows controlling audio volume of a system using hand gestures. The system tracks hand gestures and performs associated functionalities based on the performed gesture. The main component of the system is the webcam.

REFERENCES

[1] Attila Licsár, TamásSziránYi University of Veszprém, “Dynamic Training of Hand Gesture Recognition System” Department of Image Processing and Neurocomputing, H8200 Veszpré, 23-26 Aug. 2004

[2] Z. Zhang, Y. Wu, Y. Shan, S. Shafer. Visual Panel: Virtual mouse keyboard with 3d controller with standard paper clip. In Perceptual User Interfaces, 2001

[3] W. T. Freeman and M. Roth, histograms for the direction of hand perception. International workshop on automatic face and touch recognition. 1995, 12: 296-301

[4] Li-juan Sun, Li-cai Zhang and Cai-long Guo, "Technologies of Hand Gesture Recognition Based on Vision [J]", Computer Technology and Development, vol. 18, no. 10, pp. 214-216, 2008.

[5] Gao Long, Research on Static Gesture Recognition Algorithm Based on Neural Network [D], Ning Xia University, 2017.