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HAND GESTURE CONTROL OF COMPUTER

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ABSTARCT
This project promotes an approach for the Human Computer Interaction (HCI). The project uses OpenCV, an open-source computer vision library, to develop a system for controlling the volume of audio playback ,Brightness and mouse operations using hand gestures. The system captures a video stream of the user's hand using a camera, processes the video frames to detect and track the hand, and interprets specific hand gestures as commands to increase or decrease the volume, brightness,pause & play video. The system employs computer vision techniques such as thresholding, contour detection, and convex hull computation to detect and track the han , it utilizes a camera and computer vision technology to control various operations. The project demonstrates the feasibility of using computer vision techniques to develop natural and intuitive interfaces for controlling computers

INTRODUCTION
Interaction with computers are not comfortable experienceComputers should communicate with people with body language. Hand gesture recognition becomes important.
Hand gesture control using OpenCV and MediaPipe is a cutting-edge technology that uses computer vision and machine learning to enable users to control the computer with hand gestures

The OpenCV library to detect and track the user's hand.The MediaPipe framework is used to train a machine-learning model to recognize specific hand gestures as commands to operate the computer. , Hand gesture control is an innovative and highly effective technology that provides users with a natural and intuitive way to control the volume of audio playback,play pause a video,selects and opens a file,select commands, adjust brightness etc .

LITERATURE REVIEW
Several operations related to the mentioned area have been performed by various authors and are discussed below: Research work was carried out by SK. Abdul Sonia, R.V. Harshita, Y. Veera Reddy, in the International Research Journal Volume 7 Issue VII July 2018. A hand gesture volume control system using programming languages such as Python and C++ languages and using open CV module with a user-controllable high- speed computational GPU explains Cursor, volume and navigation. They implemented hand-controlled mouse cursor movement [3].

The another research paper was presented by Mokhtar M. Hasan, Pramod K. Mishra at International Journal of Image Processing (IJIP), Vol. 4, Issue 5 where they explained about hand gesture brightness control system using HSV color module for segmentation, Edge detection to store the data in the images, Recognition algorithms and Features extraction, Template matching which used raw information. In order to overcome the faults they have maximized the number of samples per gesture which increased the database size and the processing time [4].

The research work done by Vijay kumar sharma, Vimal kumar, Md.Iqbal, Sachin tawara, Vishal jayaswal at GIS Science Journal vol.7, Issue 12, 2020. In this, they explained about hand gesture virtual mouse control system where they proposed a way to control the position of the cursor with just hands without using any electronic device. The proposed system needed a webcam as an input

device and the operations are done by clicking and dragging of objects. The camera output is displayed on the system screen [5].

Rafiqul Zaman Khan and Noor Adnan Ibrahim conducted research work describing a hand gesture recognition system in the International Journal of Artificial Intelligence and Applications (IJAIA) Vol. 3, No. 4, July 2012, wherein they applied a multivariate distributed Gaussian to retrieve hand gestures using non-geometric features [6].

Research work was carried out by Munir Oudah, AliAlNaji and Javaan Chahl at J. Imaging 2020, 6, 73. In it, they explained computer vision-based hand gesture recognition. This article covers hand Silky Khurana, Jaspreet Kaur, Kamal 46 gesture techniques and identifies the advantages and limitations of the different methods used in openCV. In which they calculate the performance using openCV techniques dealing with similarities and differences, hand segmentation techniques used, algorithms and drawbacks, number and type of gestures, data set, etc [7].

Another research work by Martendra Pratap Singh, Arzoo Poswal, Eshu Yadav in the International Journal of Research Technology and Innovative Science, Volume 7, Issue 5, May 2022, explained volume control using Hand Gesture Recognition as a system that can recognize human hand gestures and use information-like input to control the device and use with real-time gesture recognition. The individual user can control the computer with hand gestures in front of the system's video camera. They developed this project with the help of OpenCV, Python [8].

METHODOLOGY

The growth in computers is immense, and it is growing in all fields. In Python, there are train libraries in the field of modulation like face detection, motion detection, and many more. The PowerPoint presentation is something that is needed in every field. The system operates by capturing motion and relating the task to be performed for the specific action or motion. The OpenCV is the library that helps get the motion detected, and it is combined with the camera where the dimension in the camera is drawn to restrict the motion in a particular area. This gesture-controlled project focuses on gesture control and how it may be used to perform specific tasks using finger movements, such as forwarding and going backwards presentation slides, clicking, and writing on the screen. Underneath the green line displayed by the camera during its deployment, the gesture is captured. The theory is used to describe how gestures are captured, recognised, and execute particular jobs which can make our work easy. The gesture recognition process focuses here on entire procedure explained below. The overall system comprises of two sections back end and front end.

Camera module is subjected for interfacing and capturing the images of gestures being made and transfer it to the detection module for handling. Detection module has the work for image processing. Whatever the images come from the camera module detection module processes it, removes all the noise from image, remove the background and make the image readable to detect the gesture. Interface module is liable for calibrating the detected hand gestures to their assigned actions to perform. These assigned actions are then sent to our application which is PowerPoint presentation and the necessary action is carried out.

The hand gestures predefined function is built to execute certain tasks such as having to scroll left and right, clicking, and writing on the screen using colours. After the gestures are recognised, the results are mapped with specific action pairs using OpenCV, cvzone's library called the Handtracking module, and the hand gestures.

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Fig.1 Virtual Mouse Flowchart

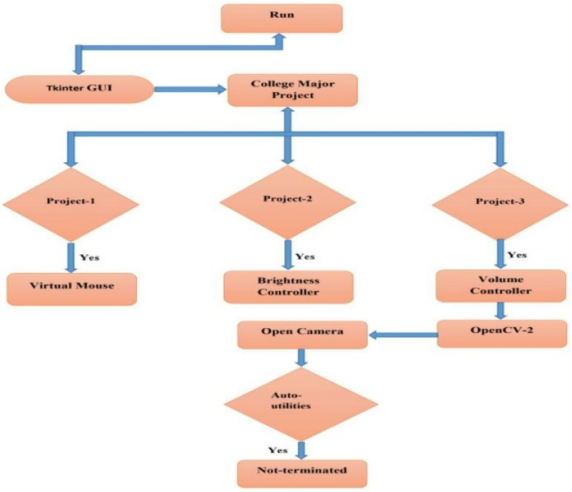

Fig.2 Volume Controller Flowchart

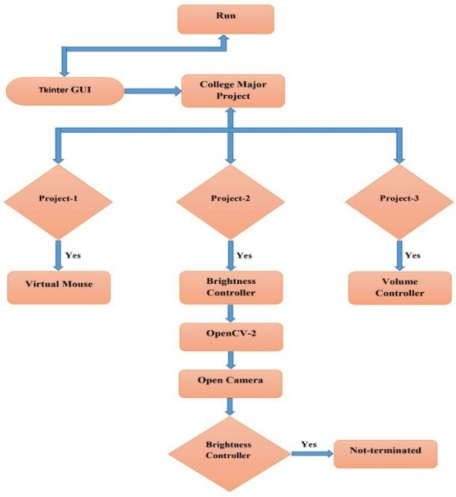

Fig.3 Brightness Controller Flowchart

IMPLEMENTATION

First, we need to install the necessary libraries and dependencies, such as OpenCV, MediaPipe, PyAudio. These can be installed using package managers like pip or apt-get.

Next, we need to set up the audio system to receive volume control signals. This can be done using the library, which provides a simple API for interacting with audio devices.

We then need to initialize the MediaPipe Hands module, which provides a pre-trained machine-learning model for detecting and recognizing hand gestures. This can be done using the MediaPipe Python API.

Once the Hands module is initialized, we can use it to capture live video frames from the webcam and detect any hand gestures in the frame. This is done using the Hand Gesture Detector class, which processes the video frames and outputs a list of hand landmarks.

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We then use the Gesture Recognizer class to analyze the list of hand landmarks and determine whether a valid hand gesture has been made. If a valid gesture is detected, the Gesture Recognizer class generates a corresponding volume control signal.
Finally, we send the volume control signal to the audio system using the PyAudio library. This adjusts the volume of the audio system in response to the detected hand gesture.

EXPECTED RESULT

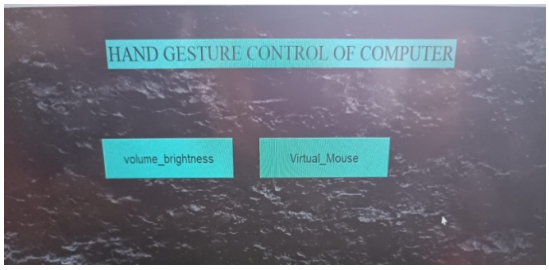

Fig.4 G.U.I project starting

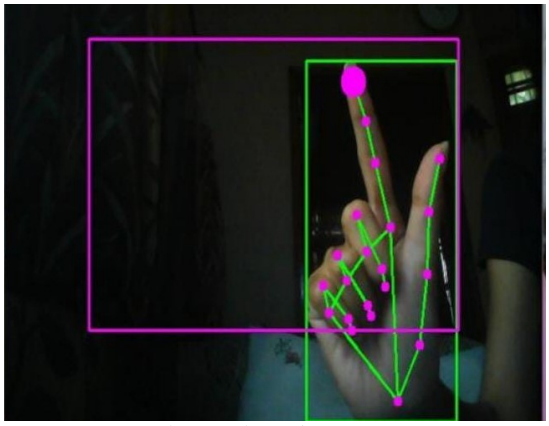
Fig 5 Virtual Mouse

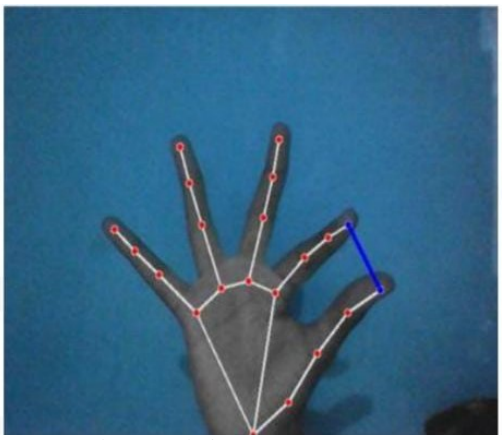
Fig 6-Brightness Decrease

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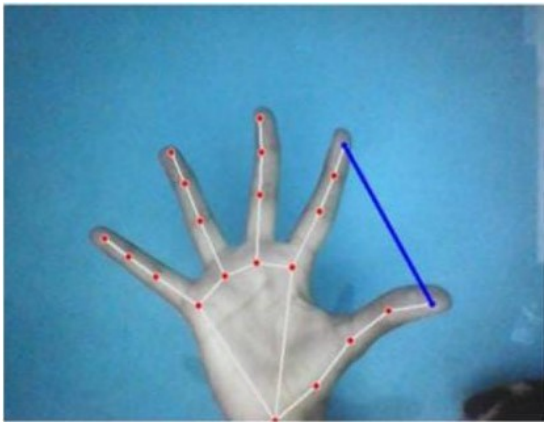

Fig 7-Brightness Increase

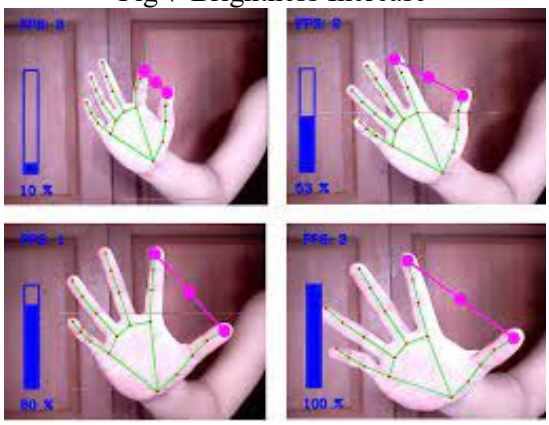

Fig 8-Change in Volume

ADVANTAGES

1.Replaces the mouse and Keyboard
2.Pointing gestures
3.Navigate in a virtual environment
4.Pick up and manipulate virtual objects
5.Interact with a 3D world
6.No physical contact with the computer
7.Communicate at a distance
8.Easy to implement
9.Product cost is low
10.Hardware and software requirements are low
11.It can make the information to be presented easily via audio, visual, or even through silent.
12.Convey information among disabled people

DISADVANTAGES

1.Light background needed for better output
2.Processing speed depend upon quality of processor
3.Gesture must be stationary

APPLICATIONS

1.Talking to a computer

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Imagine a world in which a person putting together a presentation can add a quote or move an image with a flick of the wrist instead of a click of a mouse. A future in which we can easily interact in virtual reality much as we do in actual reality, using our hands for small, sophisticated movements like picking up a tool, pushing a button or squeezing a soft object in front of us. This kind of technology is still evolving.

Fig-9 Talking to a computer

2. Medical operation

Gestures can be used to control the distribution of resources in hospitals, interact with medical instrumentation, control visualization displays, and help handicapped users as part of their rehabilitation therapy. Some of these concepts have been exploited to improve medical procedures and systems; for example, a technology which satisfied the “come as you are” requirement, where surgeons control the motion of a laparoscope by making appropriate facial gestures without hand or foot switches or voice input.

Fig-10 Medical Operation

3.Hand gesture to control the home appliances like MP3 player, TV etc.

Hand gesture-based electronic device control is gaining more importance nowadays. Most electronic devices focus on the hand gesture recognition algorithm and the corresponding user interface. Hand Gesture Based Remote is a device to replace all other remotes used in households and perform all their functions. Normally in homes, remotes are used for appliances like TV, CD player, Air Conditioner, DVD Player and Music System. Remotes are also used for lights ON/OFF control, Door Opener, etc. All these devices can be controlled by one Universal Remote. Though the technology is synchronized for all remotes (Infrared Transmission and ON/OFF modulation in the range of 32-36 kHz), there is no agreed convention on code format for data transmission. Communication between remote and appliances is established by following a predefined code.

Fig-11 Play&Pause

CONCLUSION

This paper presented a completely new system combining AI virtual mouse, volume control, and brightness control method using OpenCV, autopy, and mediapipe using corresponding fingertip movement. Interaction with the computer in front of the camera without using a physical device is implemented. This method shows high accuracy and very precise gestures that are discarded in real applications.

We also intend to add new gestures to it for easier system management and interaction with other smart systems. The tracking system can be enriched using a machine learning algorithm like Open Posture. It can also include key points on the body, hands and face for different gestures.

FUTURE SCOPE

In the future, we can implement more gestures and different types of gestures so that we will be able to perform more things and get more benefits from this. Also, we will be focusing on accuracy and helping to improve it more and more.

For future scope, we can also include whole body action and face gestures to perform certain tasks, or if we have to use some application to scroll through some different application rather than a PowerPoint presentation, we will be able to do it.Accessible to more and more people, so everyone can benefit from this and their work will be easier.

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