



# GESTURE AND VOICE CONTROLLED VIRTUAL MOUSE

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**Abstract :** This paper presents a novel Human Computer Interaction (HCI) paradigm in the field of computer science, where cursor movement is controlled in real-time using a camera and microphone. The proposed system eliminates the need for physically moving a computer mouse or pressing buttons, instead utilizing hand movements and speech as the primary means of communication. The system can perform all mouse functionalities with the help of computer vision and natural language processing techniques. The virtual mouse continuously captures real-time visuals and voice commands, which are processed and filtered to extract the relevant commands. This system can be particularly beneficial for people with hand disabilities, enabling them to control computer mouse functionalities effortlessly. Overall, the proposed virtual mouse system has the potential to advance the HCI paradigm and improve the accessibility of computer systems.

## I. INTRODUCTION

The most efficient and expressive way of human communication is through hand gestures and speech, which is universally accepted for communication. It is expressive enough for a dumb and deaf people to understand it. In this work, a real-world gesture system is proposed. Experimental setup of the system uses fixed position cost-effective web cam for high definition recording feature mounted on the top of the monitor of a computer or a fixed laptop camera. In addition to this, it uses a microphone to capture sound which is later processed to perform various mouse functions. Recognition and the interpretation of sign language or speech is one of the major issues for the communication with dumb and deaf people. Python computer programming language has been used in the given project for the code, whereas OpenCV is used for computer vision to capture gestures. For hand tracking, the model in the proposed Virtual mouse system uses the MediaPipe package. The Python package Speech Recognition is used for voice instructions

## II. METHODOLOGY

[1] One of the amazing innovations in the area of Human-Computer Interaction (HCI) is the PC mouse. In the modern age of technology, a remote mouse or a contactless mouse still uses gadgets and isn't completely free of them because they consume power from the device or possibly external power sources like batteries and take up space and electricity. Similarly, during a COVID pandemic, it is advised to maintain social segregation and refrain from interacting with objects that have been given by various people groups. This restriction could be overcome within the framework of the proposed AI virtual mouse using hand signals by utilizing a sophisticated camera or sacred camera for the perception of hand and finger gestures and PC machine vision. The framework's algorithmic rule makes use of artificial intelligence and man-made awareness. By using hand signals, the device may be operated rather easily and execute functions like left and right clicks, seeing over capabilities, and PC device pointer actions without the usage of a real mouse.

[2] Computer applications demand communication between people and machines. In contrast to conventional input methods like the keyboard, mouse, and pen, this interaction needs to be unfettered and made challengeable. In everyday interactions, hand gestures are utilized to communicate. When interacting, they are more natural than the technologies indicated above. With the employment of the hand as a device, human computer interaction is made simple. Interaction would be more fascinating if hand gestures were used to control the machine. The importance of gesture recognition has grown significantly. Various programs, like the VLC video player, robot control, gaming, virtual mice, etc., are controlled by hand gestures. Interaction is

simple, practical, and requires no additional equipment when gestures are used. It is possible to combine auditory and visual recognition. But in a noisy setting, audio commands might not function. The navigation of PowerPoint is controlled by hand gestures in the provided designed method. Here, navigation is accomplished via a combination of static and dynamic gestures. The presenter might manage the presentation more readily if gestures were used.

[3] The idea of human computer interaction was inspired by the development of computer technology. Young adults who are educated and technically adept participate in research trials on human-computer interaction. The mental model in human-computer interaction is the main topic of this study. There are several approaches to this research, one of which is to emphasize the existing methods, findings, and trends in human-computer interaction, while another is to identify research areas that were previously undiscovered but are now falling behind. This study emphasizes fidelity prototyping, which makes products more user-like by focusing on the emotional intelligence of the user. An automated system to carry out such a work is still being developed and designed.

[4] One of the marvels of Human-Computer Interaction (HCI) technology is the mouse. A wireless mouse or a Bluetooth mouse are currently not completely device-free because they still require a battery for power and a dongle to connect to the

PC. This issue can be overcome in the proposed AI virtual mouse system by utilizing a webcam or a built-in camera for the capture of hand motions and hand tip identification using computer vision. The machine learning algorithm is used in the system's algorithm. The computer may be operated virtually and can do left click, right click, and other operations based on hand gestures. Without a physical mouse, the click, scroll, and computer pointer operations are all possible. Deep learning is the foundation of the algorithm used to find the hands. As a result, the suggested method will stop the spread of COVID-19 by doing away with human interaction and the need for external devices to operate the computer.

[5] Since the development of computer technology, the method for creating a process of interaction between humans and computers is advancing. In terms of HCI (Human-Computer Interaction) technology, the mouse is a fantastic invention. Even though wireless or Bluetooth mouse technology is continuously being developed, it still requires some kind of gadget. A Bluetooth mouse needs a connecting dongle and a battery to function. The difficulty of using a mouse is increased by the inclusion of additional gadgets. The suggested mouse mechanism surpasses this restriction. An HCI-based virtual mouse system that uses hand motion and computer vision is suggested in this article. recordings of gestures taken with a webcam or a built-in camera and processed for color segmentation and detection. With hands that have coloured caps on the tips, the user will be able to control some computer cursor operations. A user can primarily scroll up or down by using various hand motions, as well as conduct left, right, and double clicks. This system uses a webcam or an integrated camera to capture frames. It then processes the frames to make them trackable, recognises various user motions, and executes mouse functions. Therefore, the suggested mouse solution removes the need for a device to use a mouse. Therefore, it can be seen that the development of HCI technology is advantageous.

[6] The hand gesture-based virtual mouse is a piece of software that enables users to interact with a device without actually using a mouse. This study introduces a computer-based creative hand gesture-based virtual mouse that generates mouse actions using hand gestures and hand tip recognition. The primary function of the recommended gadget is to replace the traditional mouse with a webcam or built-in digital camera within the laptop to perform laptop mouse cursor operations. To develop a hand gesture-based digital mouse, multiple image processing methods are used with a computer's web camera.

Vision-based CC, which replaces the requirement for a computer mouse and mouse pad, can be used to fully utilize the capability of a system camera. The use of a system camera is highly advantageous in HCI applications like motion controllers and sign language databases. A system camera is managed by a wireless mouse.

[7] For a very long time, the computer vision community has been particularly interested in the subject of gesture recognition. Hand gestures are a form of visual communication that are expressed through the position of the fingers, the center of the palm, and the overall shape of the hand. Hand gestures can be divided into static and dynamic categories. The static gesture, as its name suggests, relates to the stable shape of the hand, whereas the dynamic gesture is made up of a sequence of hand motions like waving. There are many different hand gestures that can be used; for example, a handshake differs from person to person and changes depending on the occasion and location. The primary distinction between posture and gesture is that one emphasizes the structure of the hand while the other emphasizes hand movement. Over the last ten years, computer technology has advanced significantly and has become an indispensable aspect of daily life.

### III. CONCLUSION

In conclusion, The basic goal of the virtual mouse system is to control the mouse cursor and complete activities without needing a physical mouse by using hand gestures and voice commands. This system is produced by utilizing a webcam (or any built-in camera) that recognizes hand gestures and hand tip movement and processes these frames to conduct the necessary mouse movements. The system also utilizes the idea of speech recognition to quickly follow voice directions and perform mouse activities.

The model upon rigorous testing has come out to be highly accurate and sophisticated showing enormous improvements with respect to prior existing models. Since the proposed model has been tested for high sophistication, the virtual mouse can be used for real time applications. Because the proposed mouse system may be operated digitally utilizing hand gestures and voice commands rather than the traditional physical mouse, it will be of more value in combating the propagation of viruses like COVID-19 in the current context. It functions as a useful user interface and contains all mouse features. Research on advanced mathematical materials for image processing and investigating different hardware solutions has made possible more accurate hand detections. Not only this project shows the different gesture operations and voice commands that can be done by the users but it can also demonstrate the potential in simplifying user interactions with personal computers and hardware systems. Yet a major extension to this work could be to be able to work at a more complex background and compatible with different light conditions.

#### IV. REFERENCES

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