



# Gestured Control Virtual Mouse with AI Chatbot

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**Abstract:** The AI Virtual Mouse uses computer vision techniques to track hand movements and translates them into cursor movements on the screen. The system is designed to be intuitive and user-friendly, allowing users to interact with their computer without the need for a physical mouse. The virtual mouse is developed using Python and OpenCV libraries. The project includes the implementation of various image processing algorithms, such as hand segmentation, feature extraction, and classification. Moreover, it is robust to various lighting conditions, backgrounds, and hand sizes. The developed system provides an alternative to conventional mouse devices, particularly for individuals with disabilities or those who prefer a more natural way of interacting with their computers. The target of this project is the invention of something new in the world of technology that helps an individual work without the help of a physical mouse. It will save the user money and time.

**Keywords:** : Gesture recognition, CNN algorithm, OpenCV, Mediapipe, Virtual Mouse, AI chatbot.

## 1. Introduction

In today's era of technological advancements, human-computer interaction has evolved significantly, moving beyond traditional input devices like keyboards and mice. Gesture control, leveraging the power of sensors and artificial intelligence, has emerged as a promising interface paradigm, offering intuitive and immersive interactions with digital systems.

One exciting application of gesture control technology is the development of a virtual mouse operated entirely through hand movements and gestures. This innovation not only enhances user experience but also opens up possibilities for individuals with disabilities or limitations in traditional input methods.

Additionally, integrating an AI chatbot into this system adds another layer of functionality, enabling users to interact with their devices through natural language commands, further enhancing the overall user experience and productivity.

Gesture-controlled virtual mouse systems with AI chatbot integration can empower individuals with disabilities or physical limitations, providing them with an alternative and intuitive way to interact with computers and digital devices.

The integration of gesture control technology and AI chatbots opens up exciting possibilities for human-computer interaction, revolutionizing the way users interact with digital systems. Gesture-controlled virtual mouse systems with AI chatbot integration have the potential to enhance accessibility, gaming experiences, and productivity, offering a glimpse into the future of interactive technology.

Directing device that recognizes two- dimensional motions in respect to a surface. This movement is converted into the movement of the cursor on a display in order to manipulate the GUI, or Graphical User Interface, on a computer platform. It's difficult to fathom living in our high-tech day without computers. Another of the greatest innovations ever made by humans is the computer. For people of all ages, using a computer has become a necessity in practically every aspect of daily life. We frequently use computers in daily life to facilitate our job. Consequently, HCI (Human-Computer Interaction) has become a popular area of study. The advent of the laser mouse in 2004 helped to overcome the optical mouse's drawbacks, including its inability to accurately track highly reflective surfaces, by enhancing movement accuracy with even the smallest hand movements [1]. No matter how precise a mouse is, however, there are still physical and technical constraints that must be considered. Since the release of a mobile device with touch



screen technology, people have begun to demand that the same technology be used on all other technological devices, including desktop computers. Although touch screen technology for desktop computers already exists, the cost can be prohibitive. In this project, a finger tracking-based virtual mouse application will be designed and implemented using a regular webcam. To implement this, we will be using the object tracking concept of Artificial Intelligence and the OpenCV module of Python. Therefore, an alternative to the touch screen could be a virtual human computer interaction device that uses a webcam or other image capturing devices to replace the actual mouse and keyboard. A software program will continuously use the webcam to track the user's gestures, process them, and translate them into the motion of a pointer, much like physical mouse. This movement is converted into the movement of the cursor on a display in order to manipulate the GUI, or Graphical User Interface, on a computer platform.

## 2. Literature Survey

The literature review of gesture control virtual mouse is illustrated in this segment. The researches performed and brief of it is mentioned below.

An overview of related research work has been presented in this section. Dinh-Son Tran, HyungJeong Yang, Guee Sang Lee, (2020). Survey on Real-time virtual mouse system using fingertip detection, Hand identification and segmentation with a Microsoft Kinect Sensor version 2 depth picture. It utilizes depth-sensing cameras, infrared projectors, and microphones to track human movements and gestures, enabling various applications including virtual mouse control and AI chatbot interaction.

K-cosine Corner Detection for finger tip, The K-Cosine Corner Detection algorithm is a variant of the Harris Corner Detection algorithm, adapted for detecting corners in images. In the context of finger tip detection, it can be used to identify key points or corners on the hand contour, which may correspond to finger tips.

Zhenzhou Wang (2020). Survey on Robust segmentation of the image by fusing the SDD clustering result from separate color space. Published by The Institute of Engineering and Technology Image Process, 2020. SDD clustering, or Spectral Data-driven Density-based clustering, is an approach that combines spectral clustering with density-based clustering techniques. It aims to partition data into clusters based on both density and similarity among data points.

Manjunath R Kounte, E Niveditha, A Sai Sudeshna, Kalaigar Afrose (2020). Survey on Video Based Hand Gesture Detection System Using Machine Learning. CNN

and Machine Learning, For faster calculations of neural networks, they employed the NVIDIA Jetson Nano kit. The NVIDIA Jetson Nano Developer Kit is a small, low-cost, single-board computer designed for AI and robotics projects. It's part of NVIDIA's Jetson family of products, which are specialized hardware platforms for accelerating AI computing at the edge.

Sugnik Roy Chowdhury, Sumit Pathak, M.D. Anto Praveena (2020). Published at Proceedings of the Fourth International Conference on Trends in Electronics and Informatics (ICOEI 2020). The convex hull approach is used to determine the type of hand-gesture displayed.

The system described in this paper by Aabha Waichal et al. uses a Convolutional Neural Network (CNN) model based on hand gesture recognition to control the mouse. A mouse is a pointing tool that facilitates simple human-computer interaction (HCI). It has been investigated to use pre-processing methods like k-cosine and border-tracing, background subtraction, and computing four motion matrices along with image processing methods like 3D convolutional neural network, contour and convex hull area. Using the built-in this paper proposes an interactive method of controlling the movement of the mouse by hand gesture. In this project, a practical method of controlling a mouse virtually while using a live camera was proposed. They have suggested mouse movements, clicks, scrolling (up and down), and zooming in and out. The strategy involves taking a live feed, taking out the background, and sending it to the CNN model. High accuracy is provided by the CNN model. In complex backgrounds, we can also deliver good results by using background subtraction. CNN model is trained by the dataset.

The idea of a virtual mouse using sixth sense technology has been put forth in this paper by Swati Tiwari et al. because it is highly responsive in real-time applications and uses gestures for interaction. We looked into hand gesture control for a low-cost, high-performance virtual mouse. For object recognition in this project, they have been used color tapes. By measuring the distance between the thumb and middle finger and the index and middle fingers, respectively, the left and right click events of the mouse have been achieved. When a calibrated pair of cameras is looking down at the hands with the palms facing downward, the system can specifically track the positions of the index finger and middle finger tips and finally provide an accuracy 93%.

A system that uses head and facial movements to control the mouse was proposed by T. Palleja et al. It computes four motion matrices using an algorithm for image processing. The region of interest is used to analyze the ten-frame cumulative image and find the movement. The process takes some time, which slows

down how quickly the mouse reacts.

The only input device needed for the paper which is published by Vijay Kumar Sharma et al. is a webcam. Python and OpenCV are the software programs needed to implement the suggested system. On the system's screen, the output from the camera will be seen so that the user may adjust it further. NumPy, math, and wx will be used as dependencies in Python to construct this system. and mouse. Making the machine more interactive and reactionary to human behaviour was the goal of this work. This paper's only objective was to provide a term that is portable, inexpensive, and compatible with any common operating system. By identifying the hand of human and directing the mouse pointer in that hand's direction, the proposed system operates to control the mouse pointer. The program Control basic mouse actions including left-clicking, dragging, and cursor movement.

The unique method for human computer interaction (hci) presented in this research published by Prachi Agarwal et al. uses a real-time camera to control cursor movement. The software applications required for the suggested device are OpenCV and python, and a webcam will be needed as an input device. 14 The system's display screen may show the camera's output, and the dependencies for Python are NumPy, math, wx, and mouse. In order to contribute to future vision-based human-machine interaction, they used computer vision and HCI (Human Computer Interaction) in this work. The topic of the proposed article is employing hand gestures to control mouse functionalities. Mouse movement, left- and right-button taps, double taps, and up- and down-scrolling are the primary actions. Users of this system can select any color from a variety of hues. The users may choose any color from the bands of colors that match the backdrops and lighting situations. There are a limited number of color bands defined. This could change depending on the background. For instance, the system will give the user the option to select a color from a variety of hues (Green, Yellow, Red, and Blue) when they first turn it on.

### 3. Experimental Method

The proposed system involves Designing an experimental method for evaluating a gesture control virtual mouse with an AI chatbot involves several steps to ensure validity, reliability, and effectiveness.

Formulate hypotheses based on the objectives. For example, "The gesture control virtual mouse with AI chatbot integration will improve user efficiency compared to traditional mouse input methods.

Determine the target participant group. Consider factors such as age, gender, technical expertise, etc., to ensure a diverse and representative sample

#### Advantages :

- Natural Interaction.
- Accessibility.
- Hands-Free Operation.
- Enhanced user Experience.
- Increased Efficiency.
- Adaptability.
- Versatility.
- Innovative Technology

#### Algorithms used:

##### CNN algorithm:

In gesture recognition, Convolutional

Neural Networks (CNNs) are commonly used due to their effectiveness in processing visual data such as images and videos. Here's an overview of how CNNs can be applied in gesture recognition:

Data Preprocessing: Gesture data, typically in

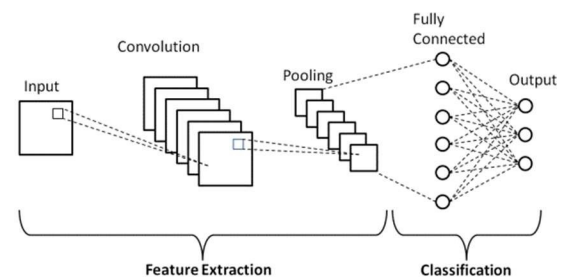


Figure. 1 CNN Algorithm

### 4. Conclusion

In the Human-Computer Interfaces (HCI) field, where every mouse movement may be done with a fast of your fingertips anywhere, it should come as no surprise that the real mouse will also be overtaken by an immersive non-physical mouse and without regard to the environment, at any moment. In order to replace the common physical mouse without sacrificing precision and efficiency, this project had to design a color recognition program. This program can recognize color movements and combinations and translate them into functional mouse actions. A few strategies had to be used because accuracy and efficiency are crucial factors in making the application as helpful as a real-world mouse. The primary objective of this method is to lessen and maintain the sensitivity of the cursor by overaging the values of the colors responsible for managing cursor motions based on a set of coordinates movements, as even a small movement could cause unintended cursor ovements. In addition, a number of color combinations were develop



with the relation of distance computations between the two colors in the combination because a difference in distance can result in a difference in the way the mouse behaves. This implementation's goal is to make it easier to control the application with minimal trouble.

As a result, accurate mouse function triggering can be achieved with little trial-and-error. Moreover, calibrations phase was included to promote effective and versatile color tracking. This enables people to select their preferred colors for various mouse functions as long as the chosen colors don't identical or comparable RGB hues (e.g. blue and sky-blue). Responsive validations were additionally developed, which essentially enables the software to save various sets of HSV levels across various angles to be utilized during the initialization step.

In regards to efficiency and lifestyle, modern technology has made significant progress in improving society's quality of life, as opposed to the other side around. Hence, cultures must not mix while hesitantly adopting outdated technologies. The latest one is accepting revisions at the IA(HONS) Information System Engineering Department of the Institute of Information and Communication Technology (Perak Campus), UTAR 40. Instead, it is advised that individuals accept modifications to lead a lifestyle that is more effective and productive.

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