

# VIRTUAL MOUSE USING GESTURE RECOGNITION

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## ABSTRACT

The mouse is an excellent device for human computer interaction. We currently use three types of mice: wired wireless, and Bluetooth. We need power to connect a dongle to a PC in all of these scenarios. This work employs cutting-edge machine learning and computer vision algorithms to recognize hand gestures, which work flawlessly without the use of any hardware. It is compatible with CNN models implemented by media pipe. In this paper, we work on S.Shriram's algorithm that propose a method for controlling the cursor's location using only one's hands and no mouse. Some actions, like clicking and dragging items, will necessitate a variety of hand movements. The proposed system will only require the use of a single computer. A camera is used as an input device. The following programs will be used: The proposed system necessitates the use of Python and OpenCV. The output of the camera will be displayed on the system's display so that the end-user can fine-tune it.

## 1 INTRODUCTION

Hand gestures are universally recognized as the most expressive and effective form of human communication. Hand signals, thumbs up, and thumbs down have always existed. Gestures are regarded as the most natural way for people to communicate with one another. It has a lot of personality. It was written in such a way that it could be understood by the deaf and dumb. So why not put it to use on our machines? In this work, we present actual hand gestures. The initial setup includes a low-cost USB web camera for system input. This paper proposes a real-time hand gesture system. The experimental setup of the system makes use of a low-cost web camera with high-definition recording capability that is installed in a fixed position. A camera mounted on a computer monitor is used to photograph a laptop. This project proposes an effective hand gesture segmentation technique based on pre-processing, background subtraction, and edge detection approaches. The Python programming language and OpenCV, a computer vision library, were used to create the AI virtual mouse system. The Media Pipe package is used to track hands and fingers, as well as the Pynput, Autopy, and PyAutoGUI packages for navigating the computer's window screen and performing operations like left click, right click, and scrolling.

The world is full of technology driven factors in our day to day life. We have so many technologies, throughout the world computer technologies are growing simultaneously. They are used to perform various tasks which cannot be performed by humans. In fact they are ruling the human lives because they have a potential to do the tasks which cannot be done by humans. The interaction between human and computer can be done with output device like mouse. The mouse is a device used for interacting with a GUI which includes pointing, scrolling and moving etc. The hardware mouse in computers and touchpads in laptops will require a huge amount of time to perform complex tasks, in case we are carrying hardware mouse wherever we go it would be damaged sometimes. After decades the technology has made the mouse functionality from wired into the wireless to improve the functionality and for the easy movements in hassle free manner. As the technologies started growing there came the speech recognition technique. This recognition is mainly used for the voice recognition purpose for searching something with the help of their voice and for translation purposes but it can take time for recognition to perform mouse functions. Later the human computer interaction evolved with the eye tracking techniques for controlling the cursor of the mouse. The major drawback of this technique is that some may wear contact lens or some may have long eyelashes so it may take some time to capture their eye movement. Different types of attempts taken by many developers for developing the models for human gesture recognition.

Those models require expensive gloves and sensors for capturing and color cap for marking the positions of the fingertips. The technologies are still emerging, one of the vast technologies artificial intelligence is playing a major role in every sector. Artificial intelligence makes human life fast and comfortable. To overcome the problems faced in the existing approaches we are going for the latest algorithms and tools in artificial intelligence. Hand gesture controlled virtual mouse using artificial intelligence is a technology that allows users to control the movement of their computer mouse using hand gestures, without the advent of a physical mouse. This technology uses a camera vision based approach to track the movements of the user's hand and to perform mouse functions on the computer screen. The system works by capturing video input from a camera pointed at the user's hand. The computer vision algorithms then analyze the video feed to identify the user's hand and track its movement. This information is given to machine learning models which have been trained to recognize specific hand gestures, such as pointing or swiping, and translate them into corresponding mouse movements. This latest super cool technology has various advantages, including its potential to improve accessibility for people and its ability to provide a more natural and intuitive user experience. It can also be useful in situations where a physical mouse or touchpad is not available or practical. The use of hand gestures as a control mechanism eliminates the need for a physical mouse and provides a more intuitive and natural way of interaction with computers. This technology has numerous applications in areas such as gaming, virtual reality and accessibility quite easy for people

## 2. LITERATURE SURVEY AND RELATED WORK

Chen-Chiung Hsieh et al. [1] proposed "A Real Time Hand Gesture Recognition System Using Motion History Image" to control the mouse cursor. The proposed method employs an adaptive skin colour detection model to reduce misclassifications. To develop these methodologies, they used a C++ software platform with the image processing library open cv installed. Kamran Niyazi et al [2] proposed "Mouse Simulation Using Two Colored Tapes," which used the Background Subtraction method, Skin Detection method, and HSV Color Model to control the cursor and perform clicking operations. The distance between the tape colours was used to guide the clicking operations. This model was created using Java software. Abhik Banerjee et al. [3] proposed a "Mouse Control Using a Web Camera Based on Color Detection" to control cursor movements and click events by detecting camera colour. Each colour represents a different cursor control, and clicking actions are performed by simultaneously detecting the colours. This method was created with the help of MATLAB software and the MATLAB image processing tool box. "Vision-based Computer Mouse Control Using Hand Gestures" [4] was proposed by Sandeep Thakur et al. To improve the efficiency and reliability of the interaction, this method employs a vision-based system to control various mouse activities such as left and right clicking with hand gestures. To improve the system's efficiency and performance, different colour caps are used on fingers to recognise hand gestures. The MATLAB environment was used to implement this method. To control the mouse cursor, Horatiu-stefan Grif et al proposed "Mouse Cursor Control Based on Hand Gesture". They used an external camera attached to a hand pad and colour strips attached to the fingers in the proposed method. To implement this methodology, they used C programming software along with an image processing library called OpenCV. Pooja Kumari et al. [6] proposed "Cursor Control Using Hand Gestures" for controlling a mouse with cameracaptured hand gestures. The camera acts as a sensor in this method, capturing and recognising colour tips attached to the hand. Because it requires the user to have colour tips on his hand in order to control the mouse, this method is also known as the marker-based approach method. To implement this methodology, they used the MATLAB environment, the MATLAB Image Processing Tool box, and the OpenCV library. Using an Extreme Learning Machine Method, Danling Lu et al. [7] proposed a "Gesture Recognition Using Data Glove" method for controlling the mouse cursor and performing clicking operations. In this method, they collected data for gesture recognition using a novel data glove. This glove is inexpensive. Advanced machine learning was used to create this method. Alisha Pradhana et al. [8] proposed the "Design of Intangible Interface for Mouseless Computer Handling Using Hand Gestures" to control the mouse cursor and click operations. This method, which employs a convex hull algorithm, was implemented using Microsoft virtual studio, a Microsoft integrated development environment. To detect the user's hand and reduce noise, a red glove is used. Aashni Hariaa et al. proposed "Hand Gesture Recognition for Human Computer Interaction," which uses a background extraction and contours detection system to improve user-computer interaction. Human interaction can be accomplished through a variety of sensor modes such as gesture, speech, facial and body expressions. In their paper, Horatiu-Stefan et al. proposed a "Human Hand Gesture Based System for Mouse Cursor Control". This model was created using a bluecolored

hand pad, a webcam, and a computer. Specific operations were carried out based on hand pad postures. This model was created using Visual C++ 2008 and the OpenCV library. For controlling the mouse cursor and performing clicking operations, Abhilash et al. proposed the "Virtual Mouse Using Hand Gesture" technique. They made a mask out of a red object in this case. This method was implemented using Python software, which included a variety of modules and functions.

This review is about how a hardware-based system is developed. Although this model produces incredibly accurate results, many movements are challenging to execute while wearing a glove that severely limits the user's hand's range of motion, speed, and agility. Also wearing gloves for a long time will result in skin diseases and is not best suited for the users with sensitive skin type. They created a machine-user interface that uses straightforward computer vision and multimedia techniques to accomplish hand gesture detection. However, a significant disadvantage is that skin pixel identification and hand segmentation from stored frames must be completed before working with gesture comparison techniques. [3] They described a system in this study for recognizing hand movements that relies on a mobile phone's camera and a connected mobile projector as a visual feedback medium. Other mobile applications can easily link to their framework to learn gesture recognition. The suggested architecture enables the quick and simple creation of research prototypes that support gestures, diverting the user's focus away from the device and towards the content. A method for performing mouse functions without any electrical equipment like sensors. It requires a webcam alone. And mouse functions like clicking and dragging files are carried out through hand gestures. The suggested model performance is low with accuracy and lacks more mouse functionality. [5] This study focuses on the advanced study of robots with gesture controls. The first section gives an idea of the art for hand gesture identification as it relates to how they are seen and captured by common video cameras. Based on estimations of the smoothed optical flow, we extract a collection of motion features. Face detection is used to produce a user-centric representation of this data, and an effective classifier is trained to differentiate. In this model the hand's center is determined, and the hand's calculated radius is discovered. And using the convex hull technique, fingertip points have been determined. The hand gesture is used to control every mouse movement. And the problem of this approach is the frame must first be saved before being processed for detection, which takes longer than what is needed in real-time. The vision based technique has been tried out in this system. Utilized a webcam for gesture recognition and detection. And no external devices like sensors and gloves were used. Completely focuses on leveraging the YOLOv5 algorithm and Artificial Intelligence (AI) to recognize hand gestures and improve HCI. [10] The system can create coloured masks utilizing techniques for color variation. Later mouse functions are carried out using hand gestures. This approach is difficult in its implementation.

### 3 EXISTING SYSTEM

A Computer Mouse is an input device that helps to point and to interact with whatever that is being pointed. There are so many types of mouse in the current trend, there's the mechanical mouse that consists of a single rubber ball which can rotate in any direction and the movement of the pointer is determined by the motion of that rubber ball. Later the mechanical mouse is replaced by the Optical Mouse.

Optical Mouse consists of a led sensor to detect the movement of the pointer. Years Later the laser mouse was introduced to improve the accuracy and to overcome the drawbacks of the Optical Mouse. Later as the Technology has been increased drastically wireless mouse was introduced so as to enable hassle free movement of the mouse and to improve the accuracy.

No Matter how much the accuracy of the mouse increases but there will always be limitations of the mouse as the mouse is a hardware input device and there can be some problems like mouse click not functioning properly ad etc., as the mouse is a hardware device like any other physical object even the mouse will have a durability time within which is functional and after its durability time we have to change the mouse

Disadvantages:

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- after its durability time we have to change the mouse

#### 4 PROPOSED WORK AND ALGORITHM

The Camera Used in the AI Virtual Mouse System The proposed system uses web camera for capturing images or video based on the frames. For capturing we are using CV library Opencv which is belongs to python web camera will start capturing the video and Opencv will create a object of video capture. To AI based virtual system the frames are passed from the captured web camera.

1. Capturing the Video and Processing The capturing of the frame was done with the AI virtual mouse system until the program termination. Then the video captured has to be processed to find the hands in the frame in each set. The processing takes place is it converts the BRG images into RGB images, which can be performed with the below code, `image = cv2.cvtColor(cv2.flip(image, 1), cv2.COLOR_BGR2RGB)` `image.flags.writeable = False` `results = hands.process(image)` This code is used to flip the image in the horizontal direction then the resultant image is converted from the BRG scale to RGB scaled image.

2. Rectangular Region for Moving through the Window The windows display is marked with the rectangular region for capturing the hand gesture to perform mouse action based on the gesture. when the hands are find under those rectangular area the detection begins to detect the action based on that the mouse cursor functions will be performed. The rectangular region is drawn for the purpose of capturing the hand gestures through the web camera which are used for mouse cursor operations. Mouse Functions Depending on the Hand Gestures and Hand Tip Detection Using Computer Vision: • For the Mouse Cursor Moving around the Computer Window

#### 5 METHODOLOGIES

##### MODULES

We all use new technology development in our everyday life. Including our devices similarly after we speak about technology the most effective example may be a computer. A computer has evolved from a really low and advanced significantly over the decades since they originated. However we also use the identical setup, which have a mouse and keyboard.. Though the technology have made many changes within the development of computers like laptop where the camera is now an integrated a part of the pc. We still have a mouse which is either integrated or an external device. This is how we've got encounter the implementation a brand new technology for our mouse where we can control the pc by finger tips and this method is thought as Hand Gesture Movement. With the help of our fingers, we will be ready to guide our cursor.

For this project we've used Python because the base language as it is an open source and simple to grasp and environment friendly. The packages that are required here is Autopy and OpenCV. Auto py is a Python module for programmatically controlling the mouse and keyboard. OpenCV through which we can control mouse events. Processing to extract required data so adds it to the computer's mouse interface in keeping with predefined notions. Python is employed to write the file. It uses of the cross platform image processing module OpenCV and implements the mouse actions using Python specific library Autopy .Real time video captured by the Webcam is processed and only the two finger tips are extracted with the use of those two fingers we can use our mouse. Their centres are measured by using the system webcam finger tips moments, and therefore the action to be taken is decided supported their relative positions and their respective distance give us the idea how far we should . The first goal is to use the function `cv2.VideoCapture ()`. This function uses to capture the live stream video on the camera. OpenCV will create a very easy interface to try to this. To capture a image we want to form an video capture object. We then covert this captured image.

#### 6 RESULTS AND DISCUSSION

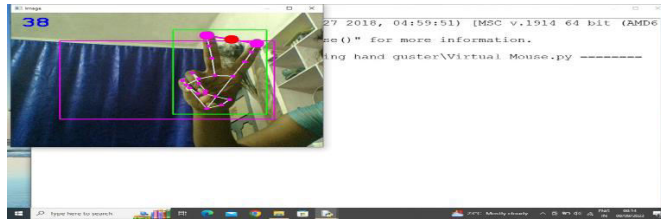


Fig 1 Brightness control

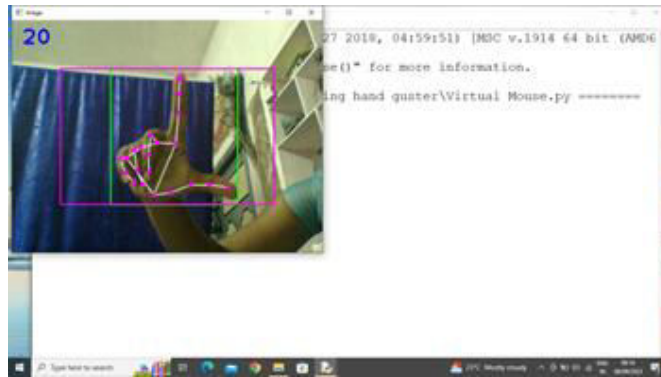


Fig.2 volume Control

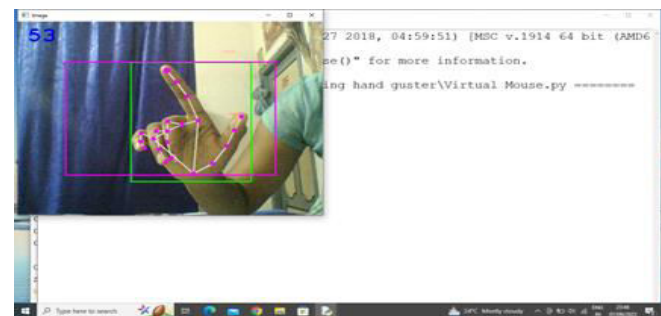
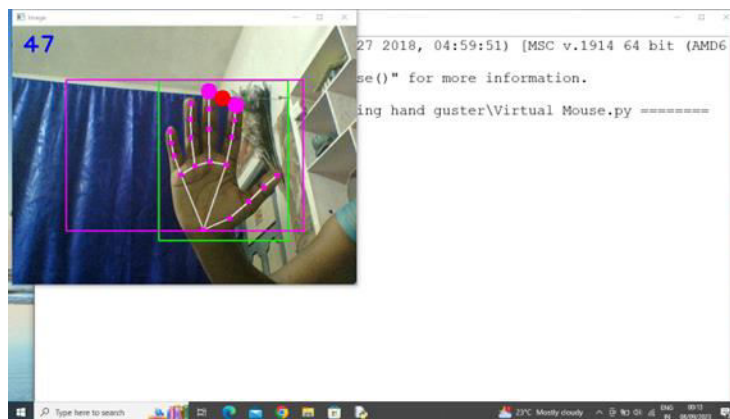


Fig.3 To move cursor



## Fig.4 Detecting fingers to perform actions

### 7.CONCLUSION AND FUTURE SCOPE

The virtual mouse system's main objective is to eliminate the need for a hardware mouse by allowing users to manage mouse cursor functions with hand gestures instead. The described method can be used with a webcam or an integrated camera that analyses frames to recognise hand movements and hand tips and execute specific mouse actions. The model has some shortcomings, including some difficulties with dragging and clicking to select text and a slight loss of precision in right-click mouse capabilities. We will now concentrate on improving the fingertip identification algorithm in order to overcome these limitations.

#### Future scope

As computer use has been engrained in our everyday lives, human-computer interaction is becoming more and more convenient. While most people take these areas for granted, people with disabilities frequently struggle to use them properly. In order to imitate mouse activities on a computer, this study offers a gesture-based virtual mouse system that makes use of hand motions and hand tip detection. The main goal of the suggested system is to swap out the conventional mouse for a web camera or a built-in camera on a computer to perform mouse pointer and scroll tasks.

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