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# Virtual Mouse Using Hand Movements

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**ABSTRACT:** In today's world, we see the growth of technology. Today's machines have something called artificial intelligence. A small part of this project is also based on artificial intelligence. This project demonstrates how to use a camera to detect finger movements in our computer windows and how we can control the entire system by simply moving a finger. With the development of technology in the field of augmented reality and the devices we use in our daily lives, these devices are increasingly appearing in the form of bluetooth or wireless technology.

This article presents an intelligent virtual mouse that uses gestures and hand gestures to perform computer mouse operations using computer vision. The main purpose of this application is to perform computer mouse cursor functions and scrolling functions using a webcam or computer's built-in camera instead of using a traditional mouse. Hand and finger pointing using computer vision according to HCI. With the AI virtual mouse system, we can use the built-in camera or webcam to follow finger movements and play games. When using a wireless or bluetooth mouse, some accessories are included, such as the mouse, a dongle to connect to the computer, and batteries to power the mouse, but for this message the user is using the built-in pin video or use the webcam and use gestures to control the computer mouse. In the planning process, the webcam captures and captures images, then recognizes various gestures and gestures, and then performs special mouse operations.

**KEYWORDS:** Mediapipe, PyAutoGUI, gestures.

## 1. INTRODUCTION

Gesture recognition is a subject in computer science and technology that aims to interpret human movements using mathematical algorithms. It is a sub-discipline of computer vision. Movements can come from any body function or state, but mostly come from the face or hands. The current focus in areas includes facial recognition and gesture recognition. Users can use simple gestures to control or interact with devices without touching their body. Many methods have been developed to interpret sign language using cameras and computer-vision algorithms. Gesture recognition can be seen as a way for computers to understand human body language and creates a better bridge between machines and humans than text-based users, legacy interfaces, and even GUIs (graphical user interfaces) that still limit most keyboard input. And mice can communicate normally without mechanical devices.

What is a virtual mouse? The virtual mouse only uses the camera to provide the interface between the user and the system. It allows the user to interact with the machine and even control mouse functions without using the machine or body.

- The user makes a movement that is captured by the camera.
- Object recognition techniques are used to extract information from captures.
- And turn it into something important on the screen.
- Better than using physical products.

### 1.1 Problem Statement

The concept of creating a smart virtual mouse can be used to overcome real-world problems such as situations where there is no place to use a physical mouse, and people with hand problems and cannot control the mouse.

In the case of COVID-19, it is also not safe to use by touching the device as touching the device may cause infection, if so, the use of AI virtual mouse is recommended to overcome these issues according to the findings. Gestures and hand gestures are used to use the webcam or the built-in camera controls the functions of the computer mouse.

### 1.2 Literature Survey

In terms of computer technology, a mouse is a pointing device that captures two-dimensional motion relative to a surface. This gesture is transformed into a floating pointer on the screen, allowing control of the computer platform's

graphical user interface (GUI). There are already many types of mouse in today's technology, there is a mechanical mouse that decides to move with a hard rubber ball that rolls as the mouse moves. A few years later, the optical mouse appeared, replacing the hard rubber ball with an LED sensor that detects motion on the desktop and sends data to the computer for processing. In 2004, the laser mouse was released, allowing the hand to move slightly to improve motion sensitivity, overcoming the limitations of optical mice that are difficult to track on very glossy surfaces. However, no matter how accurate it is, the mouse itself still has physical and functional limitations. For example, a computer mouse is a useful tool because it needs to be replaced for a long time, because the mouse buttons are broken, damaged, or because the computer itself personally stopped rejecting mouse. Therefore, another way of touching the screen could be a human computer interface device that uses a webcam or other display device instead of a physical mouse or keyboard. The device is a webcam used by software to regularly monitor user movements and translate them into moving elements, similar to the body of a mouse. Virtual mouse-based human-computer interaction using computer vision and pointing. Movements are captured by a built-in camera or webcam and processed with segmentation and colour recognition techniques. A number of human-computer interaction methods are described in this.

A method introduced by Erdem et al. Use your finger to move the mouse. Mouse control is used by defining the screen so that mouse control starts when the user's hand crosses that area.

Another method developed by Chu-Feng Lien is the concept of using the fingertip to control mouse functions. Among these, the operation of the mouse varies according to the intensity of the picture and requires the person to hold the cursor at the desired point for a certain period of time.

Another method developed by Paul et al uses finger gestures to indicate click events. Gestures are used to control the mouse. In his approach, colour symbols are used to track objects and information. Left click is used to calculate the distance between thumb and index finger, while left click is used to calculate the distance between thumb and middle finger.

Video Based Hand Detection System Using Machine Learning By Manjunath R Kounte , E Niveditha, A SaiSudeshna, Publisher of KalaigarAfrose: International Journal of Advance Science and Technology 2020 Abstract: · CNN and Machine Learning · They use nanonvidiajetson suite to speed up neural network computation. · A project focused on speed and efficiency.

## II. METHODOLOGY

### A. Camera Settings

The process is controlled by a webcam from a connected computer or desktop computer. To take a photo, we need to create a photo capture object. We can also apply colour detection techniques to any image by making simple adjustments to the code.

### B. Capturing frames

In all cases, an endless loop is used to capture the webcam image and store it for the duration of the program. We capture the flow live frame by frame. We will convert all images captured in the RGB (default) colour space to the HSV colour space. More than 150 colour space conversion methods are provided in OpenCV. But we only look at the two most commonly used, BGR for Gray and BGR for HSV.

### C. Mouse Movement

First, we must calculate the center of the two red objects found, which is easy to do by taking the center of the maximum and minimum points of the bounding box. Now we have 2 locations in the center of the 2 objects, find their diameters and get the red dots shown in the picture. We convert perceptions from camera resolution to true resolution. Then we set the position to mouse\_position. However, moving the mouse pointer takes some time.

So we have to wait until the mouse pointer gets there. So we start a loop where we do nothing there, just wait to see if the current mouse function is the same as the mouse function. This is a clear guide.

### D. Clicking

The next step is to use a close guide. Play by clicking on an object and dragging it. Similar to the opening statement, the difference is that we only have one object here, so we only need to calculate its position. It will be placed where we placed the mouse pointer. We are mousedown, not mouseup.



## 2.1 Packages used:

### Mediapipe :

It is the most widely used solution to create a network connection powered by Google. The MediaPipe framework is useful for cross-platform development because the framework is based on statistical data. MediaPipe frames are multimodal, meaning they are suitable for face tracking, face meshing, iris scanner, location tracking, hand tracking, hand tracking, segmented objects, hair, tracking and counting. . MediaPipe Framework is the best choice for developers to design, analyze and build high performance graphics systems and is also used to build various applications and systems across multiple platforms (Android, IOS, Web, Devices).

Our proposed system uses the MediaPipe platform as the configuration for the pipeline. This plumbing system installs and works across multiple platforms, allowing mobile and desktop capabilities. The MediaPipe package provides us with reliability, performance, evaluation and improvement, receives data from sensors and uses various products. The diagram shows the broadcast pipeline for packet flow between nodes.

### PyAutoGUI:

PyAutoGUI allows Python scripts to interact with other applications by controlling the mouse and keyboard. The API should be simple. PyAutoGUI is available for Windows, macOS and Linux for Python 2 and 3. PyAutoGUI has many functions: · Move the mouse and click in another application window. · Send keystrokes to applications (eg. Write as G). Take a screenshot and take an image (like a button or a checkbox) and see it on the screen. · Find and move, resize or close the application window (Windows only at this time). · Display alert windows and messages.

### OpenCV:

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning library. OpenCV was created to provide a unified framework for computer vision and to implement machine vision in products. OpenCV, an Apache 2 licensed product, allows companies to easily use and modify code. The library contains more than 2500 optimization programs, including all classes of classic and cutting-edge computer vision and machine learning algorithms. These algorithms can be used to identify and recognize faces, visual objects, classify human behaviour in videos, adjust camera movements, convert music, extract 3D models of objects, create 3D elements from a stereo camera and combine them to create high resolution images.

All scenes, find similar photos in your photo library, remove red eye from flash photos, track eye movements, recognize landscapes and set markers for augmented reality overlay and more. OpenCV has a community of over 47,000 users and an estimated 18 million downloads. The library is widely used by companies, research groups and government agencies. OpenCV, Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota etc. Apart from the library used by companies, it is also widely used by many companies such as Applied Minds, VideoSurf, Zeitera. The applications OpenCV has deployed include image compositing, video surveillance in Israel, mining equipment inspection in China, robotics and Willow Garage product selection, lake exploration and diving in Europe, interactive art in the Americas, and more. . From Spain and New York to looking for trash on the catwalk in Turkey, to inspecting labels at factories around the world, to a quick face at Japan Poop.

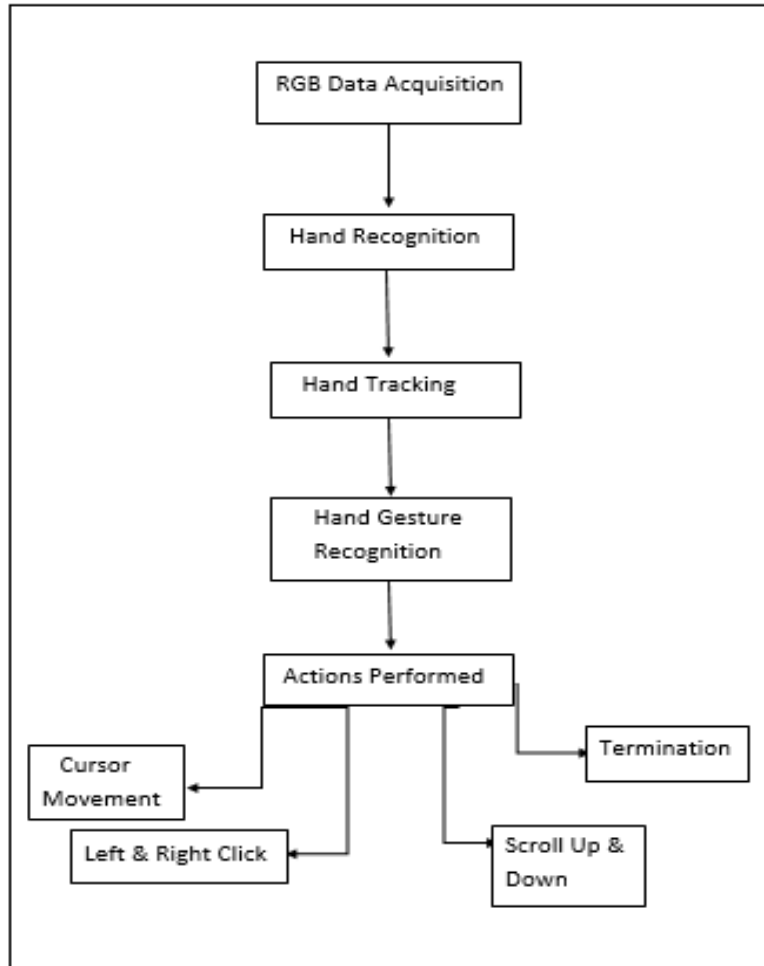
The software provides C++, Python, Java and MATLAB programming language interfaces and is compatible with Windows, Linux, Android, Mac OS and other operating systems. OpenCV itself is written in C++ and has a templated interface that conforms to STL containers.

### Matplotlib:

Matplotlib is a general-purpose library for creating static plots, graphs, and dialogs in Python. Matplotlib makes things easy and hard. Matplotlib is a cross-platform data plotting and visualization library for Python and its NumPy code extension.

It therefore provides a good open source for MATLAB. Developers can also integrate graphics into GUI applications using the Matplotlib API (Application Programming Interface).

## 2.2 UML Diagram



## III. IMPLEMENTATION

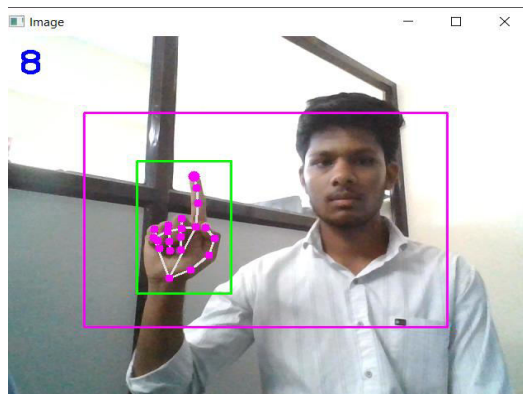


Fig1.Cursor Detection

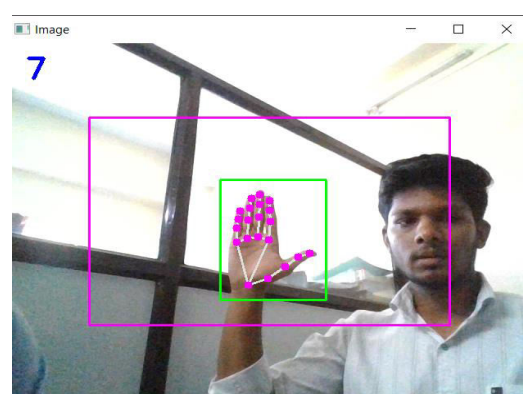


Fig2. ScrollUp

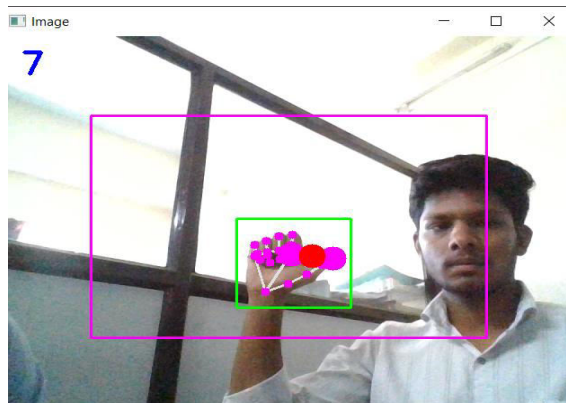


Fig2. ScrollDown

#### IV. CONCLUSION

This project demonstrates a new way of AI virtual mouse using OpenCv, autopy and mediapipe to interact with computer in front of camera with finger gestures without using body. The method shows high accuracy and is more effective than removal in real use. The proposed method overcomes the limitations of existing virtual machines. It has many advantages such as works well in different lighting conditions in low light and challenging backgrounds, and fingerprints of different shapes and sizes are equal in reality. Experimental results show that the estimator performs well in real-time applications. We also plan to add new gestures to make the system easier to handle and interact with other smart devices. The tracking process can be optimized using machine learning algorithms such as Open exposure. Body, hand and face key points can be included for different movements.

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