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# Hand Gesture Cursor using Pyhton

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Abstract

In a technologically advanced society, everyone is attempting to use innovative methods to make life simpler for people. Therefore, this study has designed a technology that may assist the user utilize laptops/computers more effortlessly and with less physical touch for humanitarian relief. The features of the suggested system include volume control with the fingertips, scrolling with the aid of yellow object identification, and system control with hand gestures. A program called Open CV has been utilized for this project, media pipe. People with impairments will find this approach useful as it will make their work easier and more straightforward. Furthermore, it may be argued that contactless technology is a priority in the modern world owing to the severe limitations during pandemics, and this prototype offers one of the greatest ways to do this.

**Keywords**—Software, Pyttsx3, Voice Engine, Media Pipe, Virtual Mouse, Computer Vision.

## Introduction

Throughout history, the area of computers has seen significant change. The size of a room may now be greatly reduced to accommodate a computer in your hand thanks to technology. In order to simplify human existence, new technologies are being created nowadays utilizing a variety of technologies. In a similar vein, this effort has tried to minimize direct physical touch with the computer by the use of a certain technology. Technology is helping to make life easier for people. There are several instances in our immediate environment. This study presents a system that has several features, such as the ability to manage the laptop or computer using hand movements, scroll using yellow object recognition, and adjust the volume using the fingers. This device reduces physical contact between computers and laptops automatically, and it may be operated simply by sitting in one spot.

At the time of the Covid pandemic, social distancing was the major measure that was followed by everyone to keep them safe. Also, considering the automatic system or the system which works using less physical contact or it can be said as a smart system, it is more beneficial for physically challenged people.

## Related Work

Joy Guha et al. [1] talked about the necessity of a contactless system. The concept was conceived during the COVID-19 pandemic, when the touch-free system was prioritized and distance was the primary demand. They used a variety of methods in the system, such as a hand-controlled mouse, right-click and left-click, etc. Additionally, the author clarified technical concepts like OpenCV module, media pipe gesture tracking, etc. This concept was developed primarily by Akhilesh Shukla et al.

[2] by concentrating on those with impairments. In order to record hand motion and hand tip for mouse pointer and scrolling operations, the author used a webcam or the computer's camera. Technologies such as media pipe and open CV were employed for this system. Using parts like a PC or laptop, a camera, and a few software programs like Windows OS and OpenCV, Devanshu Singh et al.

[3] created a model for all machines. The Open CV technology, which is an open-source library utilized for various image and video processing as well as object recognition, was described by the author in the study. In this case, the system identified the corresponding red and blue hues using the color detection approach. The hand's acquired picture is a gray patch with black space surrounding it. The greyscale image is then translated to binary scale, and the dilation and erosion theory is used to create the corresponding prototype.

A system that tracks fingers and the hand gesture method was created by S. Shriram et al.

[4]. This allowed the author to incorporate mouse features like the scrolling and pointer. Following many system checks, the author included a flow chart of the complete project with various accuracy charts in the article. The earlier challenges in the realm of color recognition systems were attempted to be addressed by Vijay Kumar Sharma et al.

[5]. By creating a system with a color-determining algorithm that works with any system with any type of color tone, a novel implementation approach was employed. Here, the author moved the pointer using two fingers separated by 15 degrees.
Kabir Hassan Shibly et al.
[6] described how they used a virtual mouse to get around the drawbacks of a Bluetooth mouse. The author also described the technique known as HCI (Human-Computer Interaction) here. By wearing color caps on their fingers, they let the user to utilize hand gestures to operate some computer tasks. Here, the author used a greyscale picture and the pixel approach to illustrate color masking. Additionally, the accuracy graph was shown following many system checks. [6]
Abhilash S. S1 et al.
[7] used hand gesture technologies to create a virtual mouse system. Here, they added many features, such as scrolling, dragging from a left click, and the recently added ability to switch between two systems. This project was implemented utilizing an open-cv application and Python programming.
Kishor Prabhakar et al.
[8] attempted to address a number of issues, including cost-effectiveness, color pigmentation differences, and indoor environment limits. Here, the author also discussed a few applications for this system that include managing various media players, games, and presentations.
The convex hull approach was employed by Ahemad Siddique et al.
[9] to recognize hand movements. With the use of several computer language libraries, the system may be readily operated after the hand gesture has been captured. The author also offered a suggestion for incorporating human voice command into the project in order to address future scope concerns.
Mumtazimah Mohamad et al.
[10] provided an explanation of Open CV and its fundamental details. Additionally, the author briefly outlined the benefits of Open CV. The document included appropriate pictures and instructions for installing Open CV and accompanying applications. OpenCV was used to create a few code examples.
With the use of a virtual mouse, Ashish Mehta et al.
[11] suggested improved teacher-student interaction. It served as both a pointer and a virtual marker. Here, they captured a person's gesture using an infrared camera. With the aid of a block diagram, the project's whole implementation was clearly presented. They linked the laptop to the projector, and the gestures of the individual are recorded by the infrared camera.
An overview of openCV and its associated history was provided by Ivan Culjak et al. [12]. With the aid of past experiences and current innovations in the workplace, the author described the changes that occurred in Open CV. The author also discussed the new libraries in the Open CV space.

## Methology

The OpenCV library and the Python programming language, which offers simple, easy-to-understand code, are used to move the cursor with hand motions.
PyAutoGUI NumPy is one of the Python modules and packages utilized here. Using OpenCV routines, the recorded video is divided into continuous picture frames. To identify any legitimate motions the user is making, the picture frames are analyzed. The system's fundamental architecture is given below.

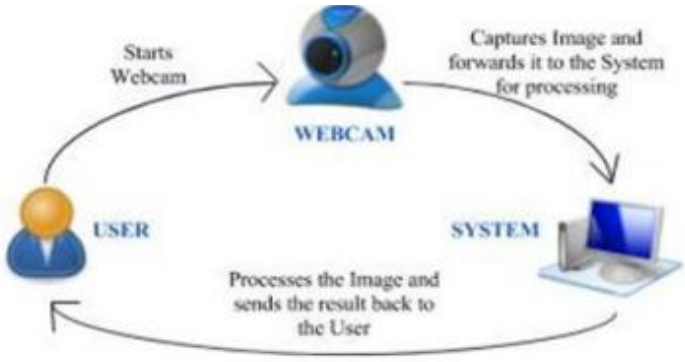


Fig. 1. Block Diagram

The following significant packages are utilized in this work: PyautoGUI (0.9.53), Media Pipe (0.8.10), Open CV-python (4.6.0.66), etc.

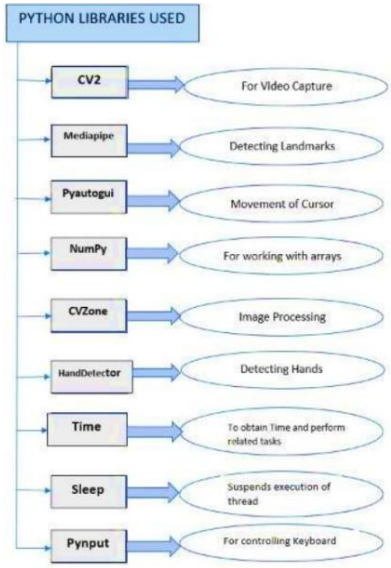


Fig. 2. Import Libraries

First, CV2 is imported in order to import the videocam. The media pipe package is used to identify hands. Additionally, a hand detector that uses the media pipe library to identify hands has been employed. Use cap=cv2.VideoCapture(0) to record video. In this case, zero indicates that the first video source will be recorded. A while loop True is utilized to play the video continually. Next, a reading from the stated cap variable is used to record the video frame. CV2 receives instructions to display the picture from cv2.imshow ('Virtual mouse', frame). In this case, the frame is called Virtual Mouse. The wait key (1) will then be used by the system to either wait or halt the video.

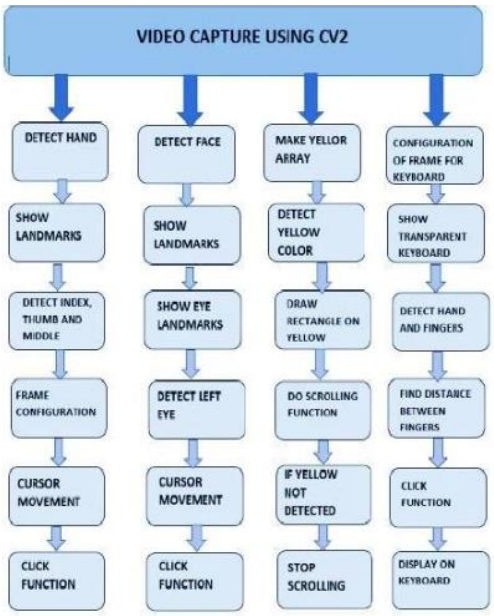


Fig. 3. Working flowchart

Detecting hands is the second stage. Therefore, the hand detector and the media pipe package are imported. RGB frame, or CV2, will change the frame's color. Therefore, the hand detector is employed to process the output. A hand contains 20 landmarks in total, and landmarks need to be created for each hand. The media pipe offers drawing tools for creating these landmarks. In order to draw in a frame, the drawing utilities will draw the landmarks and pass the hand parameter appropriately. After then, the nearby landmarks are visible.

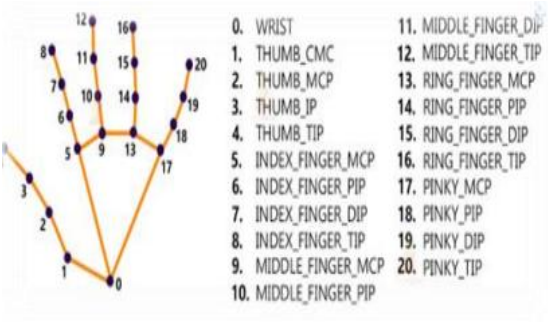


Fig. 4. Key-points of Mediapipe

It is necessary to establish a landmark index. Thus, a for loop is used to turn the landmarks into an enumeration. After then, landmarks must be used to determine the x and y positions before the X and Y are printed. CV2 is used to flip the frame. Y-axis flip(frame,1). Frame width and height are established by multiplying the former by landmark x and the latter by landmark y. The Hand Detector variable will use the media pipe solutions of the hand to detect the hand with the aid of the media pipe library. The purpose of the drawing utilities is to illustrate the hands with landmarks.

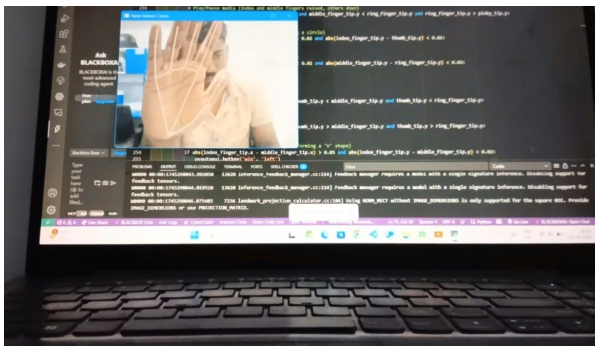

Fig. 5. Detection of hand Mediapipe.

The pyauto GUI package is used to move the pointer. The pyauto gui package makes it simple to determine the screen height and width. In this case, index_y = screen height/frame height*y and index_x = screen width/frame width*x. The thumb is used to press the left click, the middle finger is used to press the right click, and the index finger is used to move the cursor. Thus, this technological innovation allows the user to operate the laptop with their hand instead of a mouse or touchpad. All the user has to do is point their hand at the camera to operate the mouse. One important feature is that, with the aid of pyauto GUI, the keyboard's enter button will be automatically hit if the user raises his thumb while keeping his other fingers down.
The user just needs to raise his middle finger for the mouse's right button to be hit if he does so while keeping his other fingers down. This technology functions both in the background and within the IDE. The yellow lower and higher arrays are declared after importing the NumPy module. The frame will be converted to HSV if the cv2 saturation value is quite high.

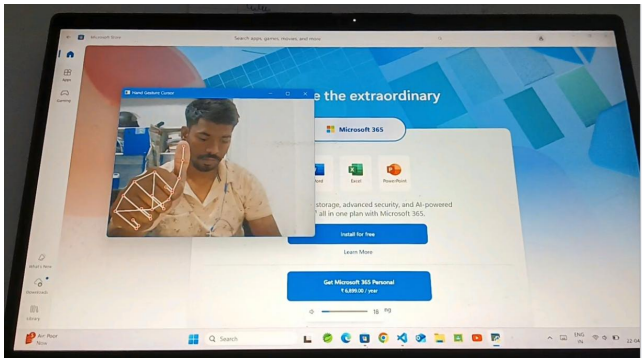


Fig. 6. Mouse Left click using left thumb.

The mouse pointer moves if the user raises his index finger while lowering his other fingers. The mouse pointer will move automatically if the user simply moves their index finger in front of the camera.

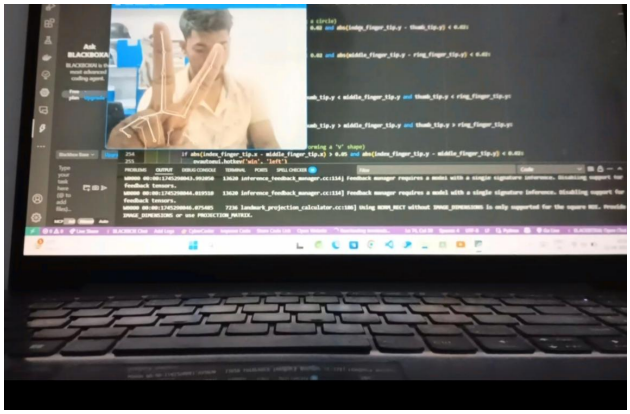

Fig. 7. Mouse cursor movement using the index finger.

After that, a mask is made using the HSV range and yellow upper and lower. cv2.imshow('mask', mask) is used to show the mask. After using a for loop to obtain an area larger than 300, the area is printed. With the given X and Y coordinates, colors, and thicknesses, the CV2 will draw a rectangle on the frame. If y<prev_y is tested, the if loop prints "moving down" and waits for prev_y=y. Imported Pyauto gui is used to carry out keyboard operations.

The next technological advancement is the automated left-click and volume control that uses hand motion recognition. Important imported libraries include math, media pipe, pyaudio, pycaw, and others. Media pipe solutions are used to identify the hand and sketch the landmarks.

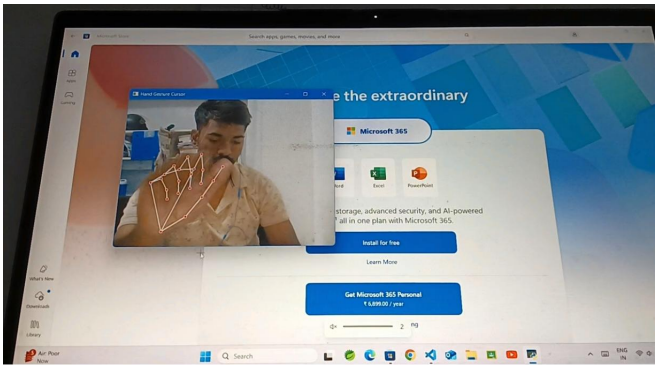


Fig. 8 Volume Control and left click of a Mouse

The thumb tip and index fingertip are connected by a line, while the index fingertip and middle fingertip are connected by another line. The system volume will be managed with the aid of the audio if there is less gap between the first line between the thumb and index finger; if there is less distance, the volume will be zero. As the line lengthens with increasing distance, the volume likewise rises in proportion.

With Pyauto gui's assistance, the left click will be pressed if line 2-the distance between the index and middle fingers - is very small.

The user must display the middle and index fingers in a specific position; if the tips of the middle and index fingers are closer together, the keyboard click is made appropriately.

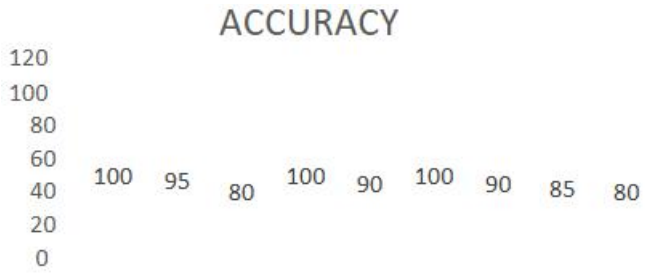


Fig. 9. Accuracy Graph

The graph displays the precise precision of the several functions that were carried out. Numerous considerations have been taken into account. The accuracy is highest when moving the cursor with hand and eye motions and lowest when using the virtual keyboard and right click.

## Conclusion

This article outlines a system that uses hand gestures to control computer programs. The technique shown here effectively produced a hand gesture recognition system that can identify the user's gesture and precisely carry out the related functions. These days, the mouse, camera, and microphone are all essential components of the computer system. Our webcam-only product would do away with the mouse entirely. Additionally, this would usher in a new era of Human Computer Interaction (HCI) in which users would no longer need to make physical touch with the computer. The existing system has some restrictions on the user's ability to operate successfully since it produces the best results on a plain backdrop. Future development will involve adding new motions that will make it easier for the user to accomplish more tasks. Additionally, efficient, performance. Only the right hand is used for motions in the suggested approach. Therefore, it is feasible to improve the suggested method by employing both hands to carry out various computer tasks. To get more precise findings, experiments must be conducted on a wider scales

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