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Virtual Mouse using Hand Gesture to avoid Infectious Diseases

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Abstract

One of the most astonishing Human-Computer Interaction (HCI) inventions is the mouse. A wireless mouse or a Bluetooth mouse now require devices and are not completely free of gadgets because they rely on a battery for power and a dongle to connect to a PC. This problem can be solved in the proposed AI virtual mouse system by capturing hand motions and recognising hand tips with computer vision utilising a webcam or a built-in camera. In the system's algorithm, the machine learning algorithm is used. Hand movements can be used to control the computer remotely, and it can perform left click, right click, scrolling operations, and computer cursor functions without the need for a hardware mouse. Deep learning is used by the system to detect hands. As a result, by eliminating human influence, the proposed technique will prevent the spread of COVID-19 and other infectious diseases. In this paper, we have discussed the implementation of AI virtual keyboard and mouse system that uses computer vision to perform mouse functions in a computer by using hand gestures and fingertip detection.

Keywords —Machine Learning, OpenCV, Media pipe, Hand tracking, Python

I. INTRODUCTION

With the advancement of technology in the field of augmented reality and everyday devices, these devices are becoming more and more compact in the form of Bluetooth or wireless technology. This paper proposes a

AI virtual mouse system that uses computer vision to perform mouse functions in a computer by using hand gestures and fingertip detection. The main objective of the proposed system is to implement the computer mouse pointer scrolling and scrolling functions using a web camera or camera built into the computer, not a traditional mouse. Like HCI with computers, computer vision is used to detect hand gestures and tricks.[1] Using the AI virtual mouse system, we can track the fingertips with hand gestures using the built-in camera or web camera and perform mouse cursor movements, scrolling and move the cursor.

Some devices, such as the mouse, the dongle to connect to the PC, and a battery to power the mouse to operate are used when using a wireless or Bluetooth mouse , but in this paper, the user uses his/her built-in camera or a webcam and uses hand gestures to control the computer mouse operations. The proposed system includes the web camera captures and then processes the frames that have been captured and then recognizes the various hand gestures and hand tip gestures and then performs the particular mouse function.

The Python programming language is used to develop virtual AI mouse systems, similar to OpenCV, a computer vision library. The proposed AI virtual mouse system model uses the MediaPipe package to track hands and hand tips, and the Pynput, Autopy, and PyAutoGUI packages to computer with left-click, right-click, and other features. Move the window screen of. -Click to scroll through the features. The results of the proposed model show very high accuracy, and the proposed model works very well in real applications that use the CPU instead of the GPU.

1.1. Problem Description and Summary The proposed AI virtual mouse system can be used to overcome real-world challenges such as instances where there is no space to use a physical mouse and also for people who have hand problems and are unable to use a physical mouse . Also, in the midst of the COVID-19 situation, it is not safe to use the devices by touching them because this may result in the spread of the virus, so the proposed AI virtual mouse can be used to overcome these problems because hand gesture and hand Tip

detection is used to control the PC mouse functions by using a webcam or a built-in camera.

1.2. Purpose. The main goal of the proposed virtual AI mouse system is to develop an alternative to the usual traditional mouse system for performing and controlling mouse functions. This can be achieved with the help of a webcam that captures hand gestures. Hand tap and then process these frames to perform certain mouse functions such as left-click, right-click, and scroll functions.

II.RELATED WORK

There have been attempts at virtual systems that use hand gesture detection when wearing gloves and also hand color suggestions for gesture recognition, but they are not more accurate than in other scenarios. Mouse functions. Recognition is less accurate due to the use of gloves; Gloves are also unsuitable for some users and in some cases identification is less accurate due to no color spikes being detected. Several attempts have been made to detect the camera hand gesture interface.

Quam introduced an early hardware-based solution in 1990, requiring the user to wear a DataGlove. Although Quam's proposed approach produces more accurate results, it is difficult to implement some of the gesture commands utilising the system [2].

In 2010, Dung-Hua Liou, Chen Chiung Hsieh, and David Lee proposed a paper titled "A Real-Time Hand Gesture Recognition System Using Motion History Image." The fundamental disadvantage of this paradigm is that it cannot handle more complex hand movements [3].

In 2013, Monika B. Gandhi, Sneha U. Dudhane, and Ashwini M. Patil proposed a study titled "Cursor Control System Using Hand Gesture Recognition." The limitation in this work is that stored frames must be processed for hand segmentation and skin pixel detection.[4],

In the IJCA Journal in 2016, Vinay Kr. Pasi, Saurabh Singh, and Pooja Kumari proposed "Cursor Control Using Hand Gestures." The system suggests using different bands to perform various mouse functions. The limitation of this is that it relies on different colours to perform mouse functions.[5]

In 2018, Chaithanya C, Lisho Thomas, Naveen Wilson, and Abhilash SS developed "Virtual Mouse Using Hand Gesture," where the model recognition is based on colours. However, just a few mouse functions are executed [6].

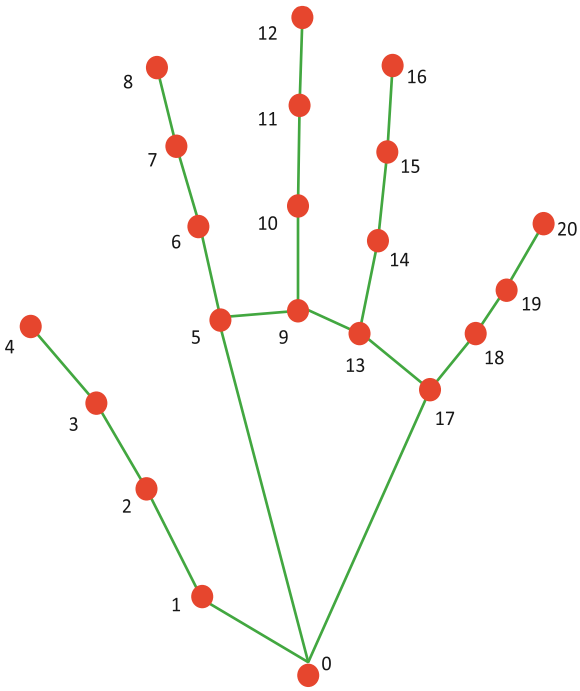
III.HANDTRACKING ALGORITHM

For detecting and tracking hand movements, the MediaPipe framework is used, while for computer vision, the OpenCV library is used. The program uses machine learning concepts to identify and recognize hand movements and hand tricks. [7–9].

MediaPipe (version 3.1) MediaPipe is a Google opensource framework that is used to use in a machine learning pipeline. Because the MediaPipe framework is based on time series data, it is suitable for cross-platform development. The MediaPipe framework is multimodal, meaning it may be used with a variety of audio and video files.
The MediaPipe framework is used by developers to design and analyse systems using graphs, and it has also been used to develop systems for application purposes. The stages involved in a MediaPipe-based system are carried out in the pipeline configuration. The pipeline developed may run on a variety of platforms, providing for scalability in mobile and desktop environments. The MediaPipe system is composed of three major components: performance evaluation, a framework for obtaining sensor data, and a collection of components known as calculators, They are also reusable. A pipeline is a graph made up of components called calculators, each of which is connected by streams through which data packets pass. Developers can replace or define own calculators anywhere in the graph, allowing them to create their own application. The calculators and streams work together to form a data-flow diagram; the graph (Figure 1) was generated with MediaPipe, and each node is a calculator connected by streams.

A single-shot detector model is used to identify and recognise a hand or palm in real time. The MediaPipe employs a single-shot detector concept. First, in the hand detection module, it is trained for a palm detection model since palms are easier to train. Furthermore, nonmaximum suppression works substantially better on small objects like hands or fists. A hand landmark model consists of finding 21 joint or knuckle co-ordinates in the hand region, as shown in Figure 1. OpenCV is a computer vision package that includes object detection picture processing techniques.

OpenCV is a Python programming language package that enables the development of real-time computer vision applications. The OpenCV package is used in image and video processing, as well as analytics such as object detection and face detection[10].



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

Figure 1: Co-ordinates or land marks in the hand

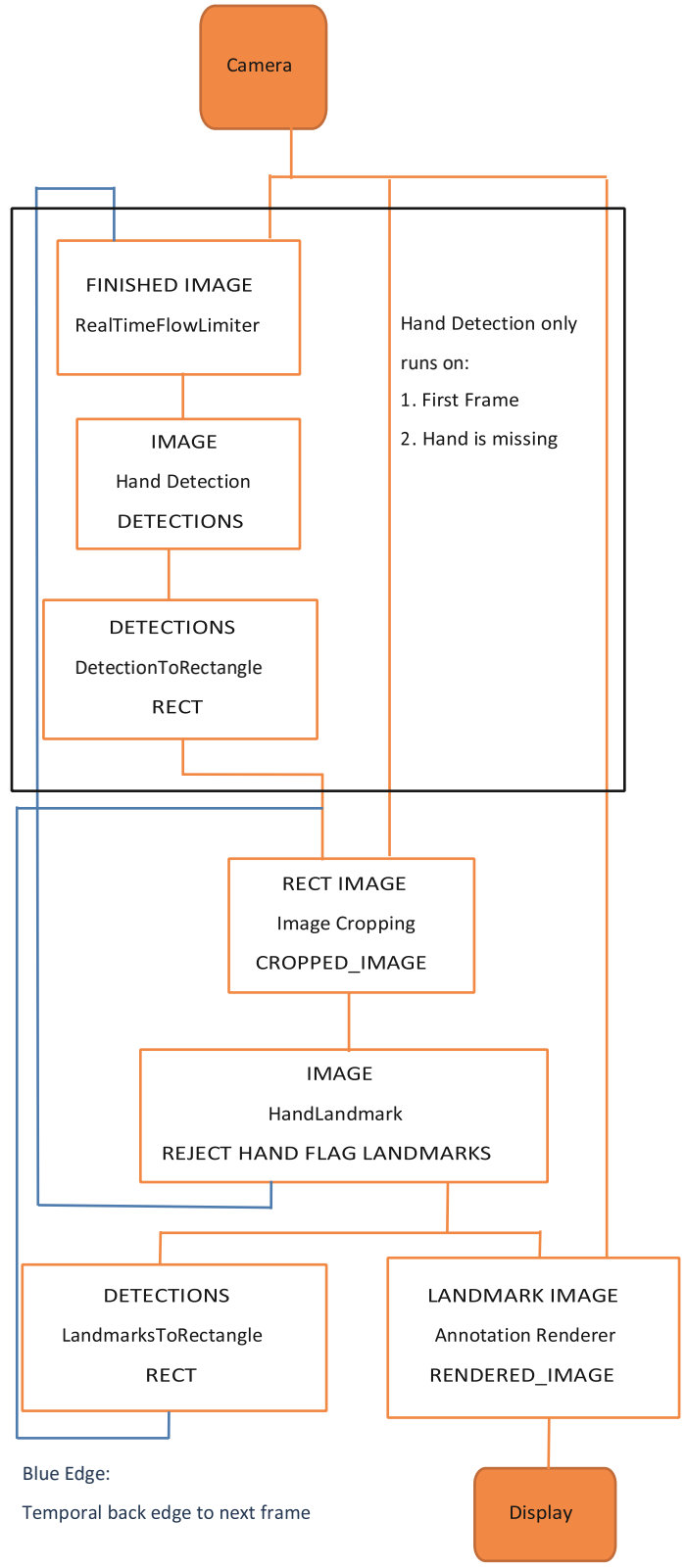


Figure 2 : MediaPipe hand recognition work flow .

IV.METHODOLOGY

The flowchart of the real-time AI virtual mouse system in Figure 2 explains the many functions and conditions used in the system.

The proposed AI virtual mouse technology is based on the frames acquired by a laptop or PC's webcam. The video capture object is constructed using the Python computer vision package OpenCV, and the web camera begins capturing video, as illustrated in Figure The web camera takes images and sends them to the AI virtual system.

4.1 Capturing the Video and Processing. The AI virtual mouse system makes use of a webcam to capture each frame till the programme is terminated. As indicated in the flowchart of figure 3, the video frames are converted from BGR to RGB colour space in order to find the hands in the video frame by frame.

4.2 Detect raised finger and perform specific mouse function. In this step, we use the corresponding finger tip Id that we found using MediaPipe and the corresponding coordinates of the pointing fingers, as shown in flowchart of Figure 2, to identify the finger which is up or down.

4.3 Mouse functions based on hand gestures and computer vision fingertip detection for the Mouse Cursor Moving around the Computer Window. If the index finger is up with tip Id 1 or both the index finger with tip Id 1 and the middle finger with tip Id 2 are up, the mouse cursor is made to move around the window of the computer using the AutoPy package of Python.

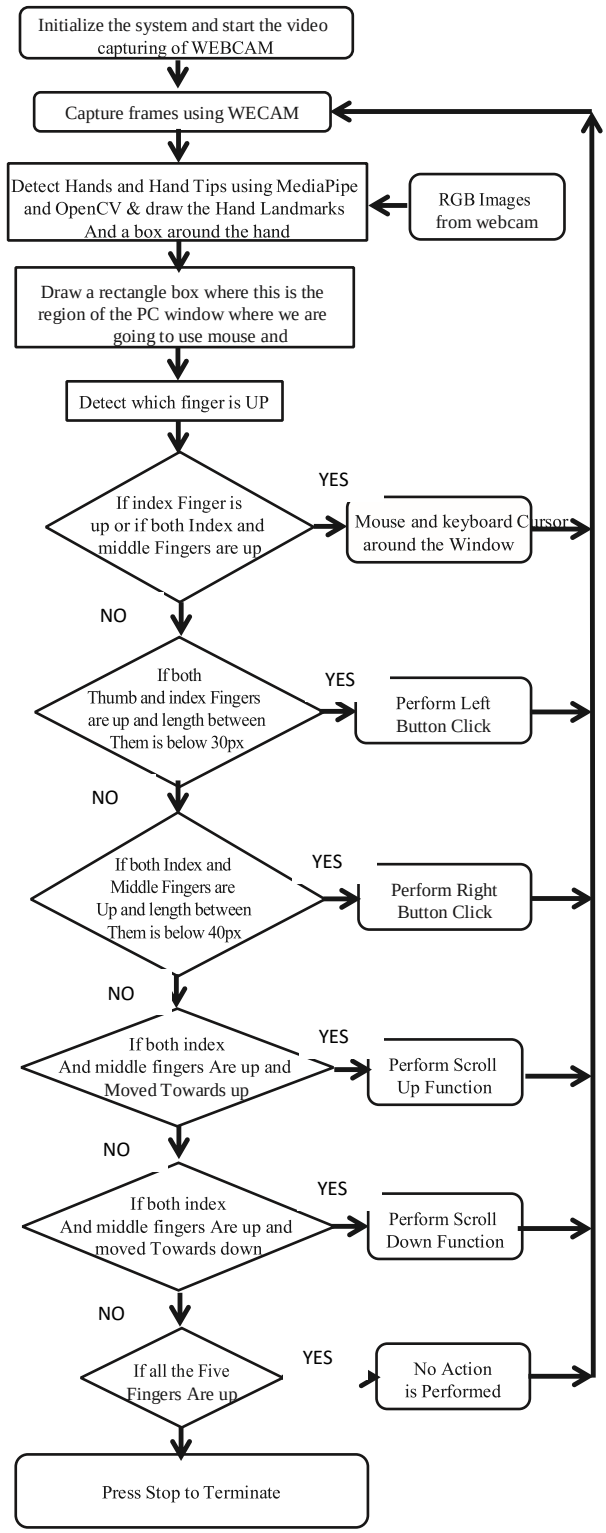


Figure 3 : Flowchart of the real-time AI virtual mouse system.

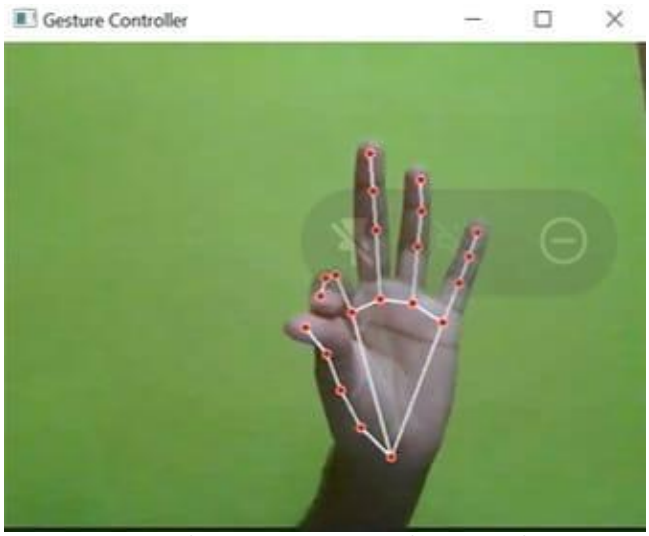


Figure 4 : Gesture for the computer to perform scroll function

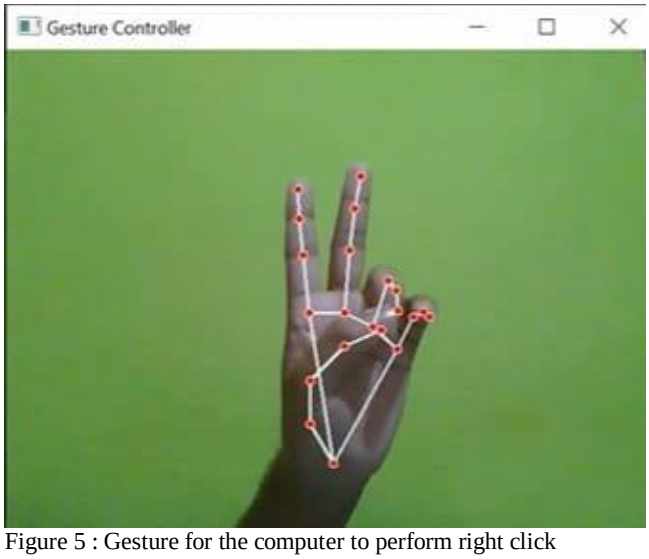


Figure 5 : Gesture for the computer to perform right click

Figure 6 : Capturing video using the webcam (computer vision).

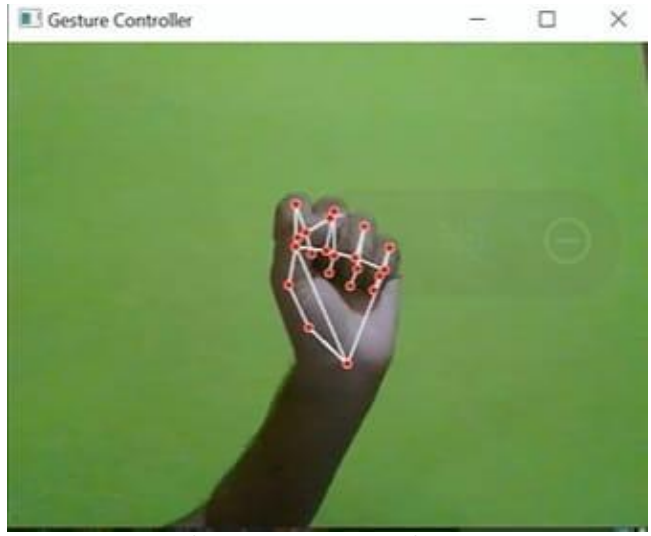


Figure 7 : Gesture for the computer to perform copy paste

4.4 For the Mouse to Perform Scroll Function

As shown in fig 4, the index finger with the tip of Id 1 and the middle finger with the tip of Id 2 are raised, and the distance between the two fingers is more than 40 pixels, the computer is designed to perform scrolling down using the using the Python PyAutoGUI module. Similarly, moving both fingers to the top of the page causes the computer to scroll upwards.

4.5 For the Mouse to Perform Right Button Click

As shown in fig 5, both the index finger with tip Id 1 and the middle finger with tip Id 2 are up and the distance between the two fingers is lesser than 40px, the computer is made to perform the right mouse button click using the pynput Python package.

4.6 For No Action to be Performed on the Screen

If all the fingers are up with tip Id 0, 1, 2, 3, and 4, the computer is made to not perform any mouse events in the screen, as shown in Figure 6.

4.7 For the Mouse to Perform Copy Paste

As shown in fig 7, all the fingers with tip Id 0,1,2,3 and 4 are down and the distance between the all fingers is lesser then the computer is made to perform the copy paste.

V.APPLICATIONS

The AI virtual mouse system is beneficial for a variety of applications; it may be used to save space while using a real mouse , and it can also be utilised in situations where we cannot use a physical mouse . The technology reduces the need for devices and increases human-computer connection.

Major applications:

i. Due to the COVID-19 situation, it is not safe to use the devices by touching them because it may result in a possible situation of spread of the virus by touching the devices, so the proposed AI virtual mouse can be used to control the PC mouse functions without using the physical mouse
ii. ii. The system can be used to control robots and automation systems without the use of gadgets. The AI virtual system can draw 2D and 3D pictures using hand motions.
iii. AI virtual mouse can be used to play virtual reality and augmented reality games without the need for wireless or cable mouse hardware.Persons with problems in their hands can use this system to control the mouse functions in the computer
iv. In the field of robotics, the proposed system can be used for controlling robots

VII.CONCLUSION

This paper proposed a hand gesture recognition system and replaces mouse function. This includes mouse and cursor movement, dragging such as alphabet printing and other functions. The proposed system is implemented using a built-in webcam or camera that recognizes hand movements and hand tips and processes these images to perform mouse actions .

VIII.FUTURE SCOPE

The suggested AI virtual mouse has various limitations, such as a little loss in the accuracy of the right click mouse function and some difficulty in executing clicking and dragging to select text. These are some of the constraints of the proposed AI virtual mouse technology, which will be addressed in future development.

IX. REFERENCES

[1] J. Katona, "A review of human–computer interaction and virtual reality research fields in cognitive InfoCommunications," Applied Sciences, vol. 11, no. 6, p. 2646, 2021.
[2] D. L. Quam, "Gesture recognition with a DataGlove," IEEE Conference on Aerospace and Electronics, vol. 2, pp. 755–760, 1990.
[3] D.-H. Liou, D. Lee, and C.-C. Hsieh, "A real time hand gesture recognition system using motion history image," in Proceedings of the 2010 2nd International Conference on Signal Processing Systems, July 2010.
[4] S. U. Dudhane, "Cursor control system using hand gesture recognition," IJARCCE, vol. 2, no. 5, 2013.
[5] K. P. Vinay, "Cursor control using hand gestures," International Journal of Critical Accounting, vol. 0975–8887, 2016.
[6] L. Thomas, "Virtual mouse using hand gesture," International Research Journal of Engineering and Technology (IRJET, vol. 5, no. 4, 2018.
[7] P. Nandhini, J. Jaya, and J. George, "Computer vision system for food quality evaluation—a review," in Proceedings of the 2013 International Conference on Current Trends in Engineering and Technology (ICCTET), pp. 85–87, Coimbatore, India, July 2013.
[8] J. Jaya and K. $anushkodi, "Implementation of certain system for medical image diagnosis," European Journal of Scientific Research, vol. 53, no. 4, pp. 561–567, 2011.
[9] P. Nandhini and J. Jaya, "Image segmentation for food quality evaluation using computer vision system," International Journal of Engineering Research and Applications, vol. 4, no. 2, pp. 1–3, 2014.
[10] K. Pulli, A. Baksheev, K. Kornyakov, and V. Eruhimov, "Realtime computer vision with openCV," Queue, vol. 10, no. 4, pp. 40–56, 2012.