IMPLEMENTATION OF HAND GESTURE-CONTROLLED MOUSE USING ARTIFICIAL INTELLIGENCE

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ABSTRACT

This article presents a proposed mouse system. In this paper, we discussed the implementation of an artificially intelligent hand gesture-controlled mouse that uses computer vision to execute mouse functions using the Colour detection technique. The virtual mouse uses the current python and computer vision algorithms for the recognition of the Masked/colored region and works seamlessly without any extra hardware requirements. A computer may be controlled remotely using hand motions, and it is capable to perform cursor movement, left-clicking, and right-clicking without the need for a hardware mouse.

KEYWORDS

Hand Gestures, mouse, Image capture, Preprocessing, Masking.

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1. INTRODUCTION

AI hand control technology is a brand-new development that allows people with limited hand usage to control their computers via hand movement recognition. It works by tracking the movements of a person's hand with a webcam or inbuilt camera. The software recognizes the position of the person's hand in space and replays that movement on the screen as a mouse cursor movement. The result is that users can control their cursor with simple movements of their hands. Many of the current iterations of AI hand control technology have been created for people with conditions like arthritis, carpal tunnel syndrome, or paralysis Ghute et al. [2018]. Such disorders result in limited hand use and often make it impossible for people to use a computer mouse. AI hand-control technology allows such individuals to regain computer control, opening up the world of online information and entertainment once more to people who have been cut off from it. The hand gesture-controlled mouse would surely lead to massive development in the field of technology Pradhan et al. [2015].

1.1. EXISTING SYSTEM

All I/O operations are controlled virtually with the assistance of masking. This implemented system aims to regulate a mouse cursor using the fingertips of the individual. A custom locking algorithm is employed to convert masked region coordinates from a virtual screen into a full-screen one to be accustomed to controlling the mouse Mali et al. [2022]. The suggested mouse system captures images using either a built-in camera or a webcam while evaluating the quality of the camera.

The virtual mouse framework can also get aware of problems with hitting in places like things that don't have room to accommodate an actual mouse and be tailored for those who have issues in gripping and can't handle an actual mouse. Assuming that if something is finished with a mouse, it may also be through with your daily webcam. An electronic device could be a handheld pointing device most ordinarily used for manipulating objects on the pc screen.

1.2. PROPOSED SYSTEM

The virtual space between the web camera and the user is described as the "Virtual Monitor," where a mouse cursor can be moved using a masked object and background subtraction. Grif H. T. et al. [2018]. We have mainly concentrated on the movement of the pointer and basic operation of the mouse like dragging and left-clicking Titlee et al. [2017]. The Python module called OpenCV is a library of programming functions, mostly focused on computer vision in real time. It uses a sampling streaming endpoint to listen to new tweets in real-time and draws them onto a virtual globe according to whatever positional information is included Grif H. T. et al. [2018] Prof. Shital Pawar et al. [2022]. It could be modified to a further extent by introducing some new features and adding hand gestures. Instead of using masking, we can control the mouse with the help of just your hand.

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1.3. USE OF PROPOSED WORK

In this system, we are controlling the mouse pointer by using colored tape or caps on the fingertips and with the open and Close gestures we are operating the mouse, we are using inbuilt libraries in Python to get the pointer coordinates and match them with the masked region from the camera to screen resolution.

2. METHOD

The methodology of each system component will be covered separately. These are the different sections:

2.1. CAMERA SETUP

The web-cam manages the mouse operations. We need to use a Video Capture object to capture a video. After that, we can capture frame-by-frame. We could apply color detection techniques to any image by making minor algorithm changes.

2.2. PREPROCESSING THE FRAMES

The web camera is continually active and captures the video during the program's duration thanks to an infinite loop. Next, each frame that was gathered in RGB (the default) color system is converted to HSV color format. Grif et al. [2016].

2.3. MASKING TECHNIQUE

We are producing a certain region with the help of a mask by the use of the original image using the threshold image and applying AND operation when we do that the masked region is then highlighted and we get the region we want and we can propose some rules to that area Chienet al. [2015] Grif et al. [2015].

2.4. OPERATION

The detected coordinate is then used to convert camera resolution to actual screen resolution Wen et al. [2012]. The position of the mouse is then set, however, it will take some time to shift the mouse pointer. Once the current mouse position and the designated mouse location are the same, we started a loop.

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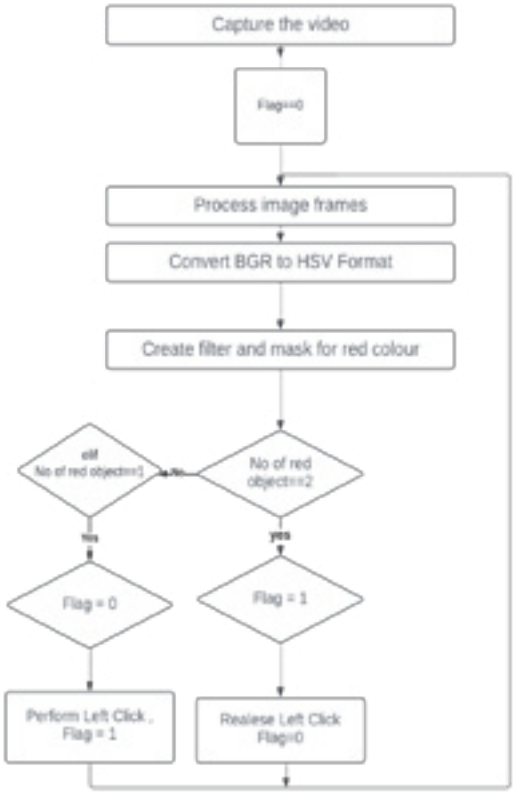

Fig 1. FlowChart of proposed Method.

2.5. CLICKING

In this instance, dragging and clicking the object is used to complete the action. It is comparable to making an open gesture, but since there is only one item, we simply need to determine its center. And we'll position that there where our mouse pointer will be.

2.6. DRAG

We introduce a variable called "flag" to implement dragging. It will be set to 1 if it was clicked in the past. So, after finding the open gesture, we click it and then double-check that the flag is set to 1. If it is set to one, the drag action is performed; if not, the mouse move operation is performed.

3. RESULT AND EVALUATION

Many of the current iterations of AI hand control technology have been created for people with conditions like arthritis, carpal tunnel syndrome, or paralysis. This implemented system aims to regulate a mouse cursor using the fingertips of the individual. AI hand control technology is a brand-new development that allows people with limited hand usage to control their computers via hand movement recognition. A custom locking algorithm is employed to convert masked region coordinates from a virtual screen into a full-screen one to be accustomed to controlling the mouse Suriya et al. [2014]. The software recognizes the position of the person's hand in space and replays that movement on the screen as a mouse cursor movement. The suggested mouse system captures images using either a webcam or a built-in camera while considering the camera quality, allowing us to reduce the number of system components. This creates a greater impact on the Environment by stopping the E-waste generation from keyboard and mouse and their wires.

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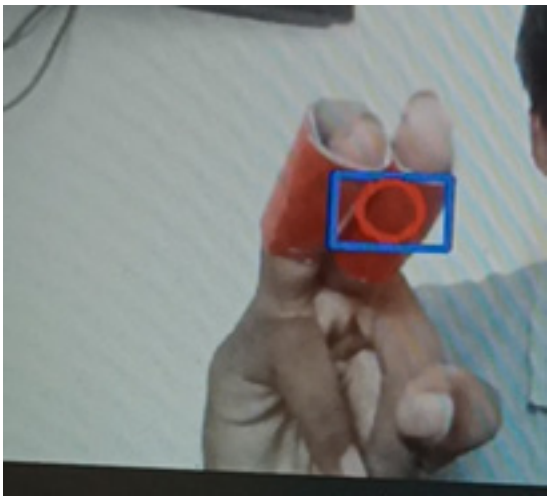

Fig 2. Hand Gesture for clicking and dragging.

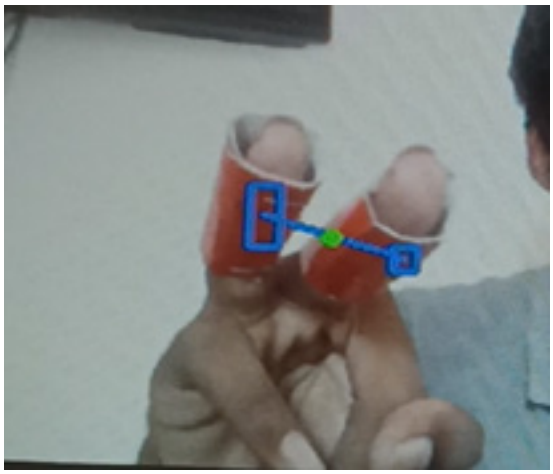

Fig 3. Hand Gesture for Deselecting.

Table I. Performance analysis (Where S-successful and U-unsuccessful).

Mouse operations No.	Detection	Drag	Left-Click	Move
1	S	S	S	S
2	S	S	S	S
3	S	S	S	S
4	S	U	S	S
5	S	S	S	S
6	S	S	S	S
7	S	S	U	S
8	S	U	S	S
9	S	S	S	S
10	S	S	S	S

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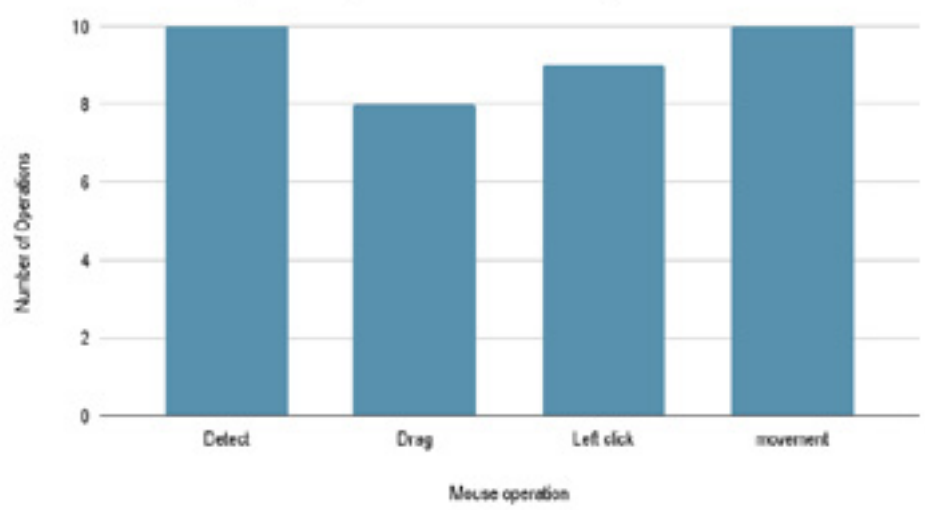

Fig 4. Number of Mouse Operation Performed Successfully.

The Histogram displays how frequently each of the four operations is carried out correctly and accurately.

The correctness of the system was assessed using the below formula to calculate the performance of the system.

$$\text{Accuracy} = \text{DF/TF x } 100$$

Where TF is the total number of operations performed and DF is the number of operations successfully recognized.

Hence, the accuracy of the system is 92.5

4. CONCLUSION

Gesture recognition is used to give the best human-machine interface. Gesture recognition is essential for the creation of new human-computer interface techniques. It facilitates more natural interactions between people and machines Grif etal. [2015]. Many different applications, including robot control and sign language recognition for the deaf and dumb, can use gesture recognition. This technique has applications in many different fields, including augmented reality, prosthetics, computer graphics, gaming, and biomedical devices. Our system's Digital Canvas, becoming increasingly popular among artists, allows them to use the Virtual Mouse technology to create 2D or 3D images while using hands like brushes and a VR headset as a display. Patients who lack control over their limbs can benefit from this device. Modern gaming consoles have incorporated computer visuals and gaming technology to create interactive games that track player actions and translate them into commands Chowdhury et al. [2020].

This work can be further extended to make the system more adaptable to various lighting conditions and background complexity. It is possible to create a user interface that is both efficient and complete in terms of mouse functionality. Additionally, it would be excellent to look into cutting-edge mathematical techniques for image processing and look into other hardware options that would produce more precise hand detections. This study illustrated the possibilities for streamlining user interactions with personal computers and hardware systems in addition to illustrating the various gesture operations that users may perform.

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