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REAL TIME HAND GESTURE CONTROL USING FINGER SEGMENTATION

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Abstract
The aforementioned elements indicate that a simulated mouse is a device that effectively uses a live video to direct the mouse cursor and achieve its objective. The software, however, is restricted to simple operations like deciding, scrolling, and changing between slides. The goal has been to lessen the reliance of the interaction options on the user's hand motions. The building of an independent gesture vocabulary framework may be another important element for related growth. If there is additional colored material in the webcam's field of view, the colour detection system may have trouble recognizing it. The proposed work seeks to create a powerful yet straightforward hardware mouse to ultimately address the flaws of the traditional hardware mouse.

Keywords: *Human Machine Interaction, gesture recognition, virtual mouse, image processing*.

I. Introduction

This research proposes a potential future approach to Human-Computer Interaction (HCI), which involves developing a virtual mouse that recognizes gestures. Rather than using a traditional mouse to navigate on-screen functions, the proposed method involves utilizing a simple camera. This technology allows the user to control computer functions and interact with them without relying on physical or mechanical devices. The technology uses gesture recognition, which can easily track and monitor the movement of the user`s fingertip by utilizing a webcam or built-in camera that is pointed at a colored cap or sticky note paper.

The system then follows the color and movement of the user's hand to manipulate the cursor. Major corporations are striving to incorporate the recognition of hand gestures technology into a range of goods and services, including computers, mobile devices, entertainment, education, healthcare, automation, and more. The device is hardware even though it does employ a camera to track hand movements. The webcam should be set up such that it can observe the user's hands in the appropriate locations in order to track fingers as a moving object and use them for mouse functionalities. Instead of a conventional mouse, it is a virtual one that only functions by tracking-colored fingertips and webcam frames. The proposed technology, which relies on a webcam, could be able to partially do away with the need for a mouse. The identification of hand gestures is a popular use of sign language technology. The aim is to create and put into use a different mouse cursor control system. A different approach identifies finger movements by using a webcam and is around technology.

The ultimate objective of this research is to create a system that uses the hue-detecting characteristics of any computer to analyze hand motions and manipulate the mouse cursor.

II. Related Work

Gesture recognition could be a cutting-edge method for computers to comprehend human body language. Instead of crude text-based communication, it will foster more advanced human-computer connection. Most gesture recognition mice that use markers for tracking employ at least two different colours. The system becomes slow and exhibits various laggings when performing as a result of having to identify multiple colours.

Chen-Chiung Hsieh and others employed a motion historical graphics hand moving direction recognition technique along with an adaptive skin colour model. The paper's main shortcoming is its inability to comprehend hand movements with greater complexity.[1]

A machine-human interaction method based on learning is proposed via Y. Zhou for distinguishing hand gesture patterns using Markov Chain Models and gesture recognition progression. Despite the method's great level of precision, it can only be used with expensive computer. [5]

M. Patil proposed a framework for Real-Time Static and Interactive Hand Motion Capture that involves designing, developing, and researching a gesture recognition system that can be utilized in various human-computer interaction applications. Nevertheless, this method has limitations in that it cannot function effectively in complex backgrounds and requires well-lit conditions to operate.[4]

Reddy suggested a virtualized mouse control that recognised hand gestures and identified finger tips. The two finger tracking techniques used in this study are gesture detection and employing coloured caps. There are three essential steps in this process: tracking hand gestures, finger detection leveraging color identification, and cursor implementation. In this study, a convex hull is formed around the contour that is detected to produce hand gesture tracking. With both the effective area of the produced hull and contour, hand features are retrieved. In-depth testing is run to verify this technique in practical situations. [2]

The significance of virtual mouse recognition in human-computer communication was proven by Varun et al. The writers illustrated the many current technical developments, including biometric authentication, which is usually found in smartphones. Another modern type of human-computer interaction is hand gesture recognition, which enables us to control our computers by waving our hands in front of a webcam. On the basis of this idea, this essay is presented. The algorithms and techniques for colour detection and the virtual mouse are thoroughly detailed in this article. [3]

According to study by Boruah et al., a recognition of hand gestures system offers a simple way to rely in the modern world. The development of teaching methods that make use of tangible things dependent on technology to enhance interaction and communication between an instructor and the learner is given a lot of attention in today's e-learning. In this study, we propose an interactive learning tool that uses a vision-based hand motion recognition system. Media Pipe is utilised by the system for motion recognition. [9]

Several virtual objects made by Unity can be controlled by the virtual mouse-based device using acknowledged hand gestures. The system was tested using six hand motions, and it was found that it could be used to successfully control a number of virtual objects.

III. Proposed Methodology

Figure 1 shows the identification of hand gestures. Using feature extraction, the hand is identified and transformed into a binary image. The palm and fingertips are split to make it simpler to identify the fingers. After that, the fingers are recognised and felt. Lastly, hand gestures are recognised using a straightforward rule classifier.

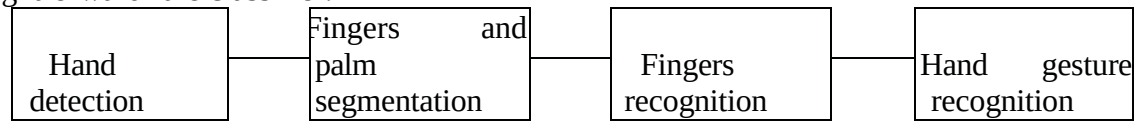


Figure 1

The main module in the system design is:

Camera Module: The installed camera on a computer or the webcam on a computer are the frames that the system uses to function. The CPU will capture webcam video in real-time by establishing the video capture object. The device index for this system would be "0" in order to employ a single camera. Other camera device indexes could be added with 1, 2, and so on. The system will get frame-by-frame data from this camera.

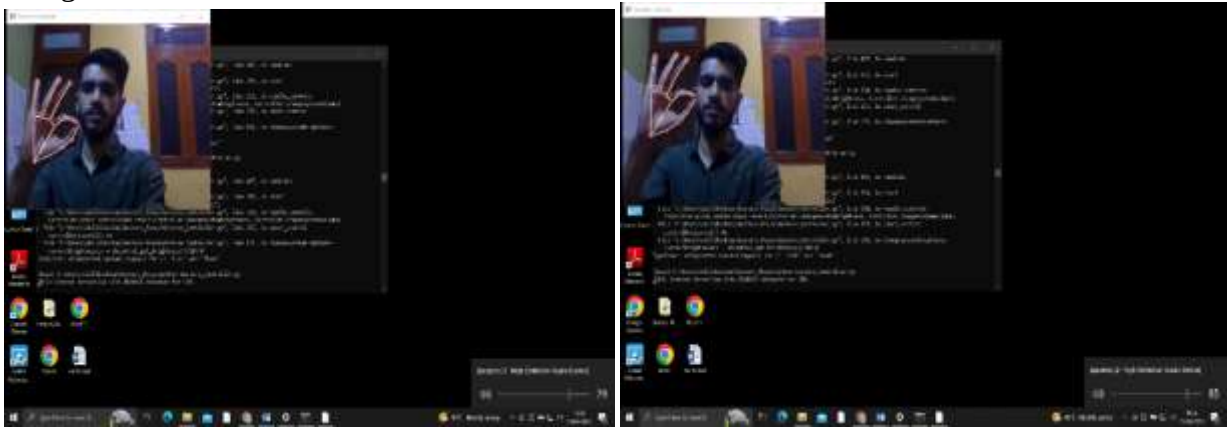
Capturing Module: The webcam records every frame until the programme ends by employing an infinite loop. The real-time video's frames are converted from BGR to HSV colour space.

Color Detection & Masking Module: In the suggested approach, colour detection achieves identifying colour pixels on the user's fingertips using colour caps from webcam frames. This is the

first and most important stage in the suggested system. The result of this stage will be a color space, with the colour cap area being highlighted and the vibrancy of the pixels differing from either the remaining of the frame in the colour cap area. The colour cap will then be tracked as rectangular bounding boxes (masks) are built around it. The performance monitoring of these colour caps will enable the detection of the gesture.

IV. Experimental Result

In order to contribute to future vision-based human-machine interaction, we have used computer vision and HCI (Human Computer Interaction) in our work. The topic of the proposed article is employing hand gestures to control mouse functionalities. Mouse movement, left- and right-button clicks, double clicks, and up- and down-scrolling are the primary actions. Users of this system can select any colour from a variety of hues. Users can choose any colour from the given colour ranges in accordance with the backgrounds and lighting circumstances. This could change depending on the background.



Software Requirements:

- Python
- OpenCV
- MediaPipe
- PyAutoGUI
- OS: - 64bit OS Windows 10 or 11

V. Conclusion

The aforementioned factors suggest that a virtual motion tracking mouse is a technology that successfully employs a real-time camera to guide the mouse cursor and accomplish its goal. However, the programme is limited to basic actions like selecting, scrolling, and switching between slides. Making the interaction modes less dependent on the user's hand motions has been the desired strategy. Another key component for related development may be the creation of a self-contained gesture vocabulary framework. The colour detection system can have problems identifying it if there is another coloured rubber in the webcam's frame of view. The proposed work aims to develop an effective yet simple hardware mouse to finally overcome the shortcomings of the conventional hardware mouse.

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