e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 6, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.54

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 6, Issue 4, April 2023 |

| DOI:10.15680/IJMRSET.2023.0604024 |

A Real Time Hand Gesture Recognition with Human Computer Interaction System

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ABSTRACT: In daily life, communicating with hand gestures is exceedingly simple and natural. The proposed system consists of three components: hand detection, gesture recognition, and human-computer interaction (HCI) based on identification, which allows for more accurate sign language recognition and reliable mouse event control. This project suggests a method for directing the cursor's position using just your hands and no gadgets.

KEYWORDS: hand detection, gesture recognition, human computer interaction

I. INTRODUCTION

In daily life, those who have some difficulties speaking or hearing tend to use hand gestures as their primary form of communication. However, there are several use cases for a gesture-based human computer interface system. Play games that don't require a mouse or keyboard, for instance, or operate robots in an environment.The goal of the project is to create a hand recognition tool that can be used to move the mouse pointer, carry out straightforward actions like clicking, and carry out other hand motion operations like transferring files across a system.A mouse is a pointing device that facilitates simple human-computer interaction. The several mouse species have undergone significant development. Starting with a cable mouse and progressing to a Bluetooth mouse, touchpad, and touch screen, and finally a glove-baseddetection mouse. The amount of connection between people and computers has significantly risen, and the field is continually evolving as new techniques and procedures are developed. One of the most sophisticated areas where computer vision and artificial intelligence have aided in improving deaf people's communication and supporting gesture-based signalling systems is hand gesture recognition. Hand gesture recognition hasseveral subdomains, such as sign language recognition, sports-specific signal language identification, humanaction recognition, position andposturedetection, exercise monitoring, and management of smart homes and assisted living.An unstable object such as hand, is a sequence of fleeting, intermediate gestures would result from switching from one gesture to another, and the HCI system shouldn't react to them. When a fresh

gesture signal is received from the identification process, we suggest a straightforward technique to manage the system's behaviour and stop it from responding to the gesture signal right away in order to increase the system's dependability. When a signal is received that results in a command with a high cost or low likelihood, proposes a more

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reliable system by including a feedback mechanism to make confirmation with the human operator.

II. RELATED WORK

Sai Mahitha G. et al., (2021) [1] proposed a method for virtual mouse based using color detection technique. In their model the mouse cursor of the system can be controlled just on appearing our fingers before the computer's web camera. Their finger gestures are captured and controlled through a Color Detection technique of webcam. There system allows us to direct the system pointer by using our finger bearing color caps or tapes and the operations like dragging of files and the left click would be performed by using distinct finger gestures. It also performs the transfer of files among two PC's in a single similar network. They developed system makes use of only a less resolution webcam which acts as a sensor for tracking the user's hands in two dimensions. If the prespecified colored caps camouflage with the background they will not be detected and thus no movement of the mouse is possible.

Tran, DS. et al.,(2021) [2] proposed a virtual mouse method using RGB-D images and fingertip detection. The hand region of interest and the center of the palm are first extracted using in-depth skeleton-joint information images from a Microsoft Kinect Sensor version 2, and then converted into a binary image. Then, the contours of the hands are extracted and described by a border-tracing algorithm. The Kcosine algorithm is used to detect the fingertip location, based on the hand-contour coordinates. Finally, the fingertip location is mapped to RGB images to control the mouse cursor based on a virtual screen. This study still suffers from several limitations that are mainly inherited from Microsoft Kinect.

V. Tiwari et al., (2020) [3] used VGC16 as pre-trained model to achieve image classification. It compares its results with different models such as Baseline CNN, three block VGG model. The paper also incorporated the data augmentation in the VGC3 model to study its effect on accuracy. The implemented VGC16 model has the accuracy of 98.97% which is quite an improvement over the accuracy of 55.075%, 74.561%, 61.404% of Baseline CNN, VGC3, VGC3+Data augmentation respectively.

K. S. Varun et al., (2019) [4] developed models which are based on color detection and mouse movement based on highlighted color which is given from the user for the movement of the mouse. A two figure input can be seen where it is forming two rectangles and forming an average point from both the figures. That point will be acting like a mouse pointer. Once the point moves the mouse pointer in the runtime also moves along. So using this the movement of the mouse can be implemented. The updating of the mouse pointers depends on the position of the prespecified colored caps in the mask that is created for understanding the system. The created mask is converted from RGB background to a black and white that will be used for the detection of the prespecified colored objects that will help for the movement of the mouse. If the prespecified colored caps camouflage with the background they will not be detected and thus no movement of the mouse is possible.

S. M. S. Shajideen and V. H. Preetha (2018) [5] proposed a model which has hand pointing gestures incorporated with other hand gestures in 3D space. Two USB cameras are used which are placed orthogonal to each other to obtain top view and side view of different hand gestures. MATLAB software is used for it. For separate two views, the two detectors are trained and choosing various image samples for various directions at the top & side view. At the training stage, binary patterns are applied for image conversation and feature generation for each sample. Then two cascade detectors were built which depends on AdaBoost feature selection. At the testing stage, the transformation of the input image to the working image, each and every detector monitors & scan the working image in each view separately.

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III. METHODOLOGY

The proposed system for real time hand gustier for virtual mouse operation is grouped into six main components which is depicted in fig.1

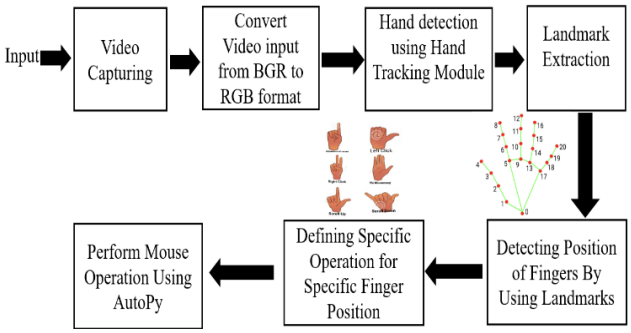

Figure 1:Proposed Methodology

In the Methodology, the method used in each component of the system will be explained separately.
There are following subsections:

- Video Capturing
- RGB Format
- Hand Detection
- Landmark Extraction
- Defining Specific Operation
- Performing Mouse Operation

a. RGB format:

In digital devices like computer monitors, televisions, and virtual mouse pointers, a wide spectrum of colours can be produced using the RGB format, which uses red, green, and blue colour values. When using a virtual mouse pointer, the colour of the pointer can be adjusted using the RGB format. The pointer might, for instance, be set to the colour red with the RGB values (255, 0, 0), green with the RGB values (0, 255, 0), or blue with the RGB values (0, 0, 255).Virtual mouse pointers that can be easily customised and have a pleasing visual appearance can be made by combining various amounts of red, green, and blue values to produce nearly a limitless range of colours.

b. Hand detection using hand tracking module:

The approach of locating hands in a frame of an image or video and determining their presence is known as hand detection. Contrarily, hand tracking includes both identifying the hand and continuously monitoring its movements over time. The Hand Tracking Module also offers details about the hand, such as the location of the fingertips, the centre of the palm, and the direction of the hand. Using this data, you may carry out a number of operations, like hand tracking in virtual reality or gesture and sign language detection.

c. Land mark extraction:

In order to control the position of the cursor on a computer screen, landmark extraction in cursor movement by hand gesture entails detecting and tracking certain spots or landmarks on the hand as it moves in space.

d. Perform mouse operation:

It entails mapping various hand gestures to particular mouse functionalities to carry out a variety of tasks, such as file transfers and left, right, and double clicks.

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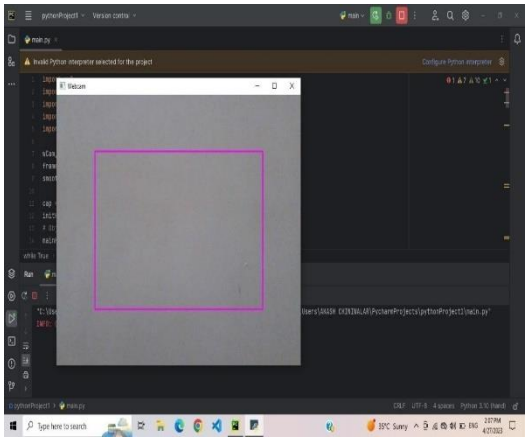
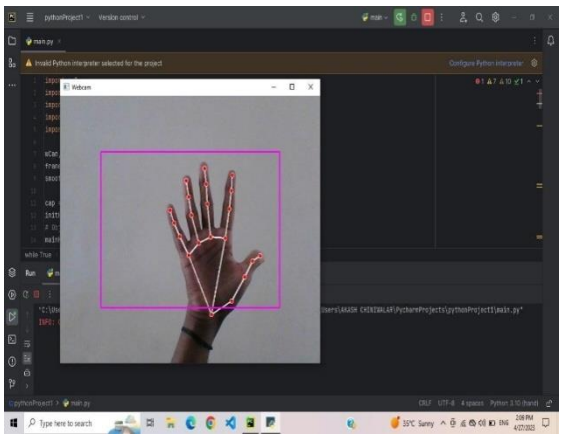
IV. EXPERIMENTALRESULTS

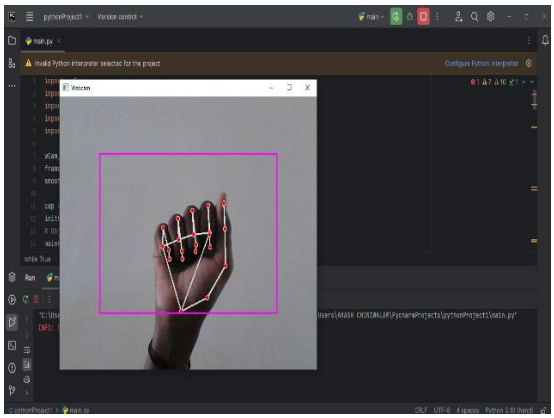
Figures shows the results of identification of real time hand gesture recognition with human computer interaction system. Fig 1 (a) Live input using webcam. (b)Area for hand detection. (c) Recognization of gestures.



(a) Live input using webcam



(b)Area for hand detection



(C) Recognition of gesture

V. CONCLUSION

A few strategies had to be used because accuracy and efficiency are key factors in making the programme as helpful as a real-world mouse. There is no longer a requirement for a real mouse after the implementation of this type of application. This motion tracking mouse (virtual mouse) replicates each and every movement of a physical mouse.The programme needs a number of additions and enhancements to become more versatile, accurate, and user-friendly in a variety of settings.

The following describes the improvements and the features required:

a) Smart Movement:Due to the fact that the existing identification mechanism is only capable of recognising objects within a 25 cm radius, an adaptive zoom in/out function is necessary to increase the covered distance. This function can automatically modify the focus rate dependent on the distance between the users and the webcam.

b) Better Accuracy & Performance:The hardware of the computer, including the processor's speed, the amount of RAM that is accessible, and the webcam's functionality, all have a significant impact on response time. As a result, the

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programme might function more smoothly when it's installed on a good computer with a webcam that works well in a variety of lighting conditions.

c) Mobile Application:In the future, this web application will also work on Android devices, where hand motions will replace the touchscreen notion..

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Impact Factor
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