Hand Gesture Control: Using Computer Vision Technology

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1. INTRODUCTION

Hand gesture detection is one of the busy study areas in the field of human-computer interactions because of its adaptability and user-friendliness. The most natural form of communication is this. This article demonstrates how to control the pointer using only our hands and no other objects. By enabling users to complete duties without contacting the computer's hardware, the concept also helps to stop the propagation of viruses. Our method uses a camera and computer vision technology that includes image segmentation, backdrop subtraction, and color tracking to manage mouse movements like left-clicking, right-clicking, double-clicking, audio up/down, brightness variation, and scrolling. We show how it can carry out each job just as well as a typical mouse gadget.

Nonverbal communication that uses the observable body to convey a clear message is known as a motion. The hands, cheeks, or other body components may change as part of the gesture. An important strategy in the study of human-computer contact is the classification of hand movements. These gestures can control tools at work in addition to serving as a mouse and keypad in virtual reality applications. In this research, a virtual mouse system with computer vision-based artificial intelligence (AI) is proposed, which senses hand movements and hand tips to direct mouse operations. The AI virtual mouse system can recognize the tip of a hand motion, execute mouse pointer operations, scroll, and more using an integrated camera (1080p or 4K) or a web camera.In nonverbal communication, motions are used.

2. LITERATURE SURVEY

[1].How the method is used will depend on the pictures that are taken. TensorFlow and OpenCV object models are used to identify hands. Additionally, it has been improved so that motions used to execute activities like page turning and scrolling up and down can now be recognized by the computer.

[2].While vision-based motion detection is ready for practical use, research is still needed in uncontrolled settings.

[3].Giving the user hands-free mouse cursor direction is the primary objective of the AI visual mouse system. We can use an onboard video or a webcam to log into the server.

[4].The simulated mouse technology that uses artificial intelligence (AI) has worked incredibly well and is more precise than the current design. The suggested method can be helpful in circumstances like the COVID case that occur in real life.

[5].They described a sensor-based data gathering glove in this paper that has flex sensors, an IMU, and FSRs for identifying commonly used welcoming motions.

[6].The main result of a real-world experiment performed for this research demonstrates that it is possible to effectively use computational resources by merging the use of a motion classifier and a hand detector in line with the proposed scheme.

3. METHODOLOGY

a mechanism that makes it possible for machines and humans to communicate directly. It includes instructions on how to use the applications. Users can work more easily (5 to 12 meters distant) and without the use of extra accessories like mice thanks to this technology. Additionally, it gives the user options for quick internet access.

The simulated mouse device that has been proposed is based on webcam pictures from a notebook or PC. The video capture object is constructed using the Python computer vision framework OpenCV, and the web camera begins capturing.The virtual system downloads and analyzes web camera footage.

identifying the up-pointing digit and carrying out the necessary mouse operation. We can now identify which finger is up and the appropriate mouse function will be carried out in line with that identification using the tip ID of the corresponding finger we found using the MediaPipe and the corresponding co-ordinates of the fingertips that are up.

Libraries involved in this project are:

3.1)MediaPIPE: The camera can now recognize things as a consequence. It could be a solitary thing or a group of things.

3.2)OpenCV: It will take a photo of the item that the media pipe has detected before starting image processing to identify and map every edge on the hand.

3.3) Numpy: The hand recognition records were kept in this library. (several values can be kept, such as the tips of the index and middle fingers and all 20 edges combined).

3.4)Pynput: Information on left-clicking, right-clicking, single-clicking, double-clicking, scrolling, and other mouse motions can be found in this collection.

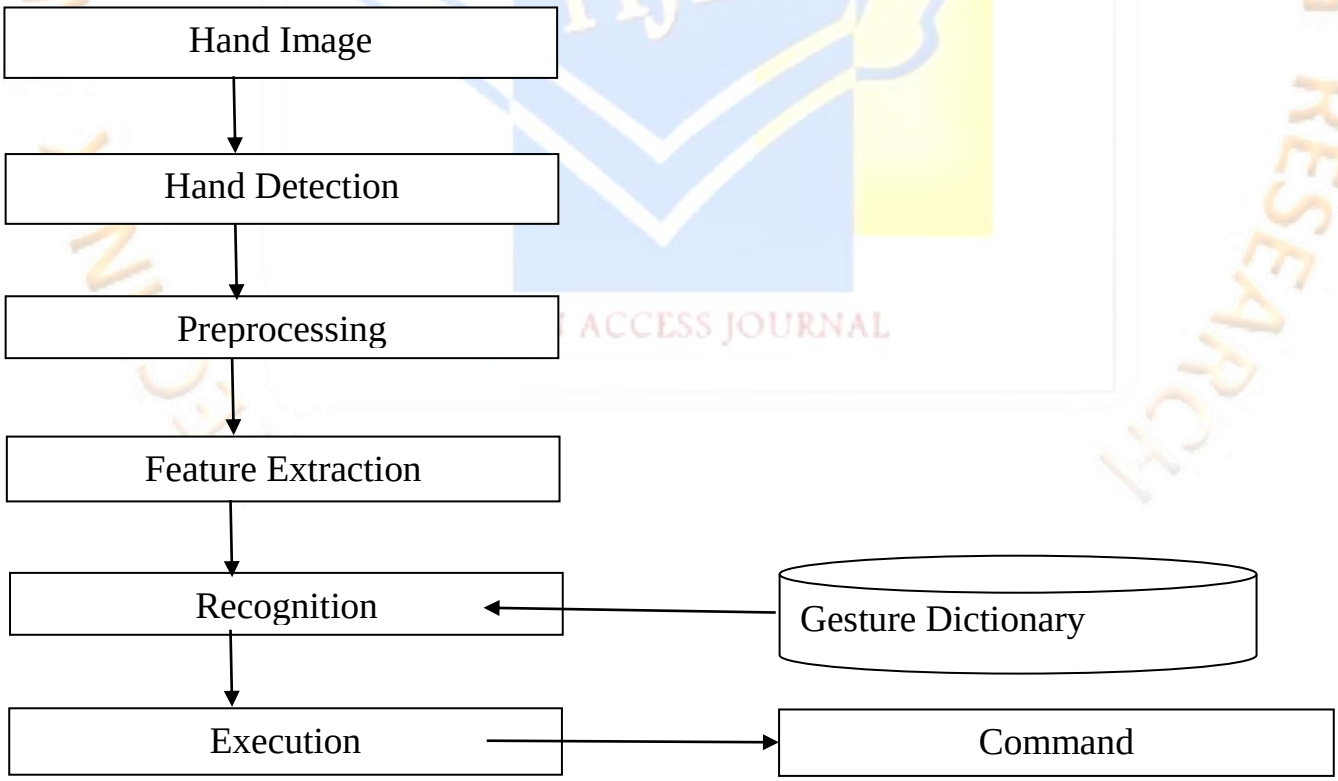


Fig 1. Design of proposed system

Hand Image: A hand is shown in front of a monitor or built-in camera to take photos for later use.

Hand detection: Hand recognition is the process of identifying a hand from an input picture while simultaneously tracking the hand's movement and position using computer vision.

Preprocessing: Before we can derive features from hand motion data, the images need to be analyzed. Noise, unintentional errors, and data economy must be eliminated in order to use the data for additional picture processing.

Feature Extraction: The feature extraction phase is part of the dimensionality reduction process, which breaks down the size and intricacy of an original collection of raw data into digestible chunks. Processing will be easier as a result. The most important characteristic of these enormous data sets is that they contain a wide range of various factors. It takes a lot of processing power to handle these factors. By selecting and combining factors into features, feature extraction assists in effectively removing the best feature from those huge data sets. These characteristics, while still being user-friendly, correctly and distinctively characterize the actual data collection.

Execution: Clicking, scrolling, copying files, and pasting are some activities that rely on the motion of the hand in front of the web camera.

Gesture Dictionary: Every hand action in front of the camera is recorded and saved in the numpy library.

Command:enables computers and systems to usefully extract data from digital pictures, videos, and other visual inputs.

4.IMPLEMENTATION

1)Controlling cursor:We must position our hands in the form of a win to control the cursor's progress.

2) Left click: The index finger is enclosed to symbolize the left hit.

3) Right click: The middle finger, when surrounded, stands in for the right hit.

4) Holding the mouse: We have to show the camera our complete hand. It serves as a substitute for the retained pointer.

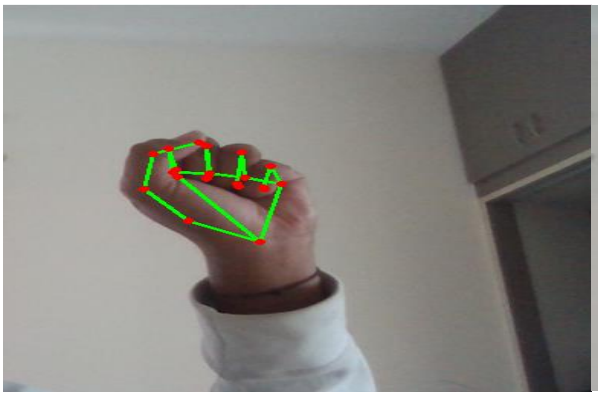
5) Cut: We can execute a cut action by connecting the index and middle fingers in the controlling position.

6) Choosing one or more files: The files in that area will all be selected if you move your fingertips across the screen while maintaining the location.

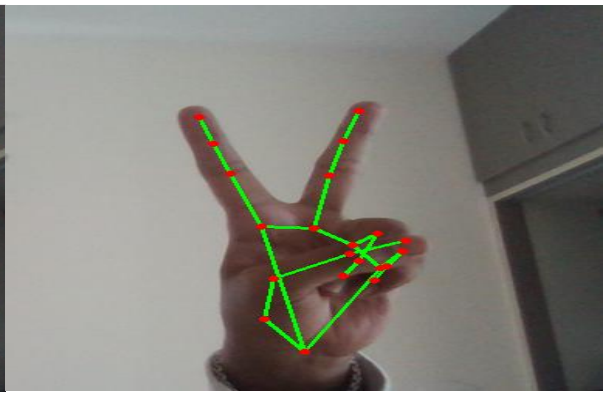
7)Scrolling: The scrolling function is managed by pressing our palms downward and upside-down from the control position.

8) Volume control:Depending on how far the pinch motion is stretched or contracted from its beginning position, the volume will vary. The volume will alter if we move while keeping the volume page active.

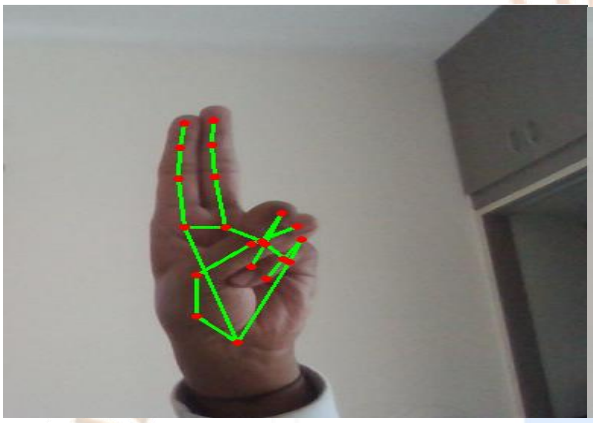
9)Brightness control: Brightness adjustment is similar to level control. Depending on how far the pinch motion is stretched from the beginning point, brightness can increase or reduce. The luminance will change if we maintain the action while opening the Display tab.



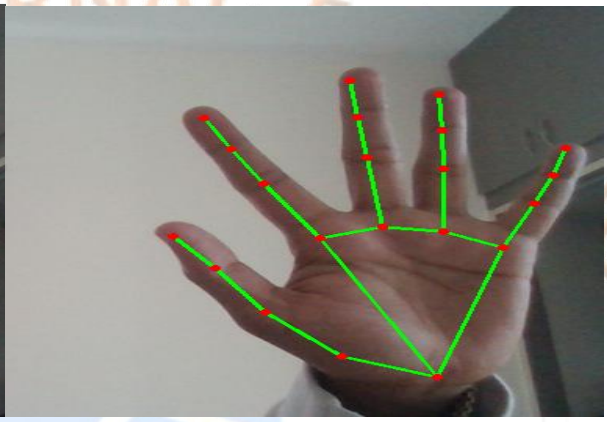
Img 1. Gesture for the computer to select files



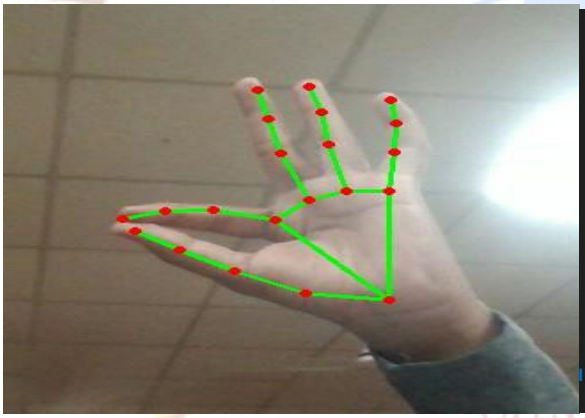
Img 2. Gesture to control mouse operation



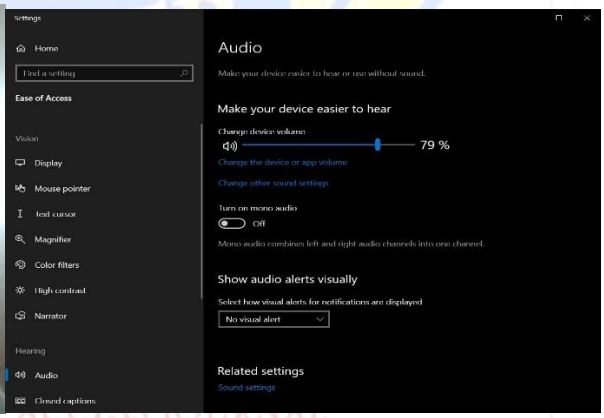
Img 3. Gesture to perform cut operation



Img 4. Gesture for moving the cursor



Img5.Gesture to perform volume control



Img6. Display of volume control

Fig 2. System Recognition Hand Gestures

5. Experimental Results

The suggested AI virtual mouse system introduces the idea of using computer vision to improve human-computer contact.

Comparing testing of the AI virtual mouse system is difficult because there are so few samples available. Finger tip recognition and hand motions have both been tried for hand gesture tracking in varying illumination conditions and distances from the camera.

The proposed model's ability to mimic most mouse motions, such as left- and right-clicking, up- and down-scrolling, and mouse pointer movement, using fingertip detection makes it innovative. The device is helpful for virtually operating a computer while using a physical mouse.

6. CONCLUSION

The primary emphasis of this article is on intuitive system entry using hand motions and a webcam or built-in camera. The standard file operations—opening, shutting, moving, cloning, and pasting—as well as a few keyboard shortcuts—are used in this project. For instance, by considering some issues raised in the other referenced pieces, the working distance between the user and the system is enhanced.

In this endeavor, an efficient use of hand gesture control necessitates a powerful CPU, outstanding camera resolution, and quick RAM.

7. REFERENCES

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