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HAND GESTURE BASED AI VIRTUAL MOUSE

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ABSTRACT

The rapid advancement of artificial intelligence (AI) and computer vision has paved the way for innovative human-computer interaction techniques. This paper presents an AI-based virtual mouse system that enables users to control a computer using hand gestures, eliminating the need for a physical mouse. The system leverages a Convolutional Neural Network (CNN) algorithm, along with computer vision techniques, to accurately recognize hand gestures and execute corresponding mouse functions such as right-click, left-click, double-click, scrolling, volume control, and drag-and-drop.Developed using Python and OpenCV, the proposed system processes real-time images from a webcam, applies image processing techniques, and extracts key hand features to perform various operations. The CNN model enhances accuracy and adaptability, allowing the system to function effectively across different lighting conditions, backgrounds, and hand sizes. This technology offers a user-friendly and cost-effective alternative to conventional input devices, benefiting individuals with disabilities, professionals seeking a touch-free interface, and general users looking for an intuitive method of interaction.The virtual

mouse system is evaluated based on accuracy, speed, and robustness and is compared with existing gesture-based input solutions. The results demonstrate that the system provides efficient and precise control, making it a viable alternative to traditional mice. By improving accessibility and convenience, this AI-powered virtual mouse contributes to the future of human-computer interaction.

KEYWORDS: *Hand Gesture Recognition, Convolutional Neural Network (CNN), Opencv-Python, Virtual Mouse, Human-Computer Interaction (HCI), Image Processing.*

REFERENCES

1. Chaihanya C, Lisho Thomas, Naveen Wilson, and Abhilash SS in 2018 proposed "Virtual Mouse Using Hand Gesture," where the model detection is based on colors, but only a few mouse functions are performed.
2. Dung-Hua Liou, Chen Chiung Hsieh, and David Lee in 2010 presumed a study on "A Real-Time Hand Gesture Recognition System Using Motion History Image." The primary drawback of the proposed system is the implementation of complicated hand gestures.
3. Monika B. Gandhi, Sneha U. Dudhane, and Ashwini M. Patil in 2013 presumed a study on "Cursor Control System Using Hand Gesture Recognition." In this work, the limitation is that the stored frames are needed to be processed for hand segmentation and skin pixel detection.
4. Quam in 1990 achieved a hardware-based system; in this model, the user is supposed to wear a data glove. Although Quam's model gives highly accurate results, many gestures are difficult to perform with a glove that restricts most of the free movement, speed, and agility of the hand.
5. Saurabh Singh, Vinay Pasi, and Pooja Kumari in 2016 proposed "Cursor Control Using Hand Gestures." The model offers the use of various bands of colors to perform a variety of mouse operations. Its limitation is owed to the fact of the requirement of different colors to perform required functions.
6. Sneha U. Dudhane, Monika B. Gandhi, and Ashwini M. Patil in 2013 conceptualized a study on "Cursor Control System Using Hand Gesture Recognition." In this system, the drawback is that the frames have to be stored first and then processed for detection, which is much slower than what is required in real-time.
7. V. K. Pasi, Saurabh Singh, and Pooja Kumari in 2016 conceptualized "Cursor Control Using Hand Gesture" in the IJCA journal. The system suggests the use of different bands to perform different functions of the mouse. The limitation is that this approach requires processing stored frames for hand segmentation and skin pixel detection.