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Gesture Controlled Mouse: Navigating Virtually with Hand Gestures

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Abstract: This paper presents an innovative approach to enhance the recognition of human hand postures within the realm of Human-Computer Interaction (HCI) applications. The primary objectives are to streamline computing processes, minimize user effort, and enhance comfort in hand posture manipulation. The authors introduce a novel application designed for computer mouse control, leveraging a sophisticated algorithm and hand feature selection methodology. Through rigorous testing, the application demonstrates commendable performance in terms of time efficiency. Moreover, the integration of hand postures with a voice assistant further enhances user experience, facilitating smoother system operation. Overall, this research offers promising advancements in HCI by amalgamating intuitive hand gestures with intelligent technological solutions.

Keywords: Human-Computer Interaction(HCI), Gesture Recognition, Opencv, Mediapipe, Mouse Control, Machine Learning.

I. INTRODUCTION

Implementing a virtual mouse using hand gestures involves leveraging computer vision techniques to track hand movements and interpret gestures as commands to control a cursor on a screen. This technology utilizes cameras, often in devices like webcams or specialized sensors, to capture hand movements in real-time. By analyzing the positions and gestures of the hand, algorithms can determine the corresponding actions, such as moving the cursor, clicking, or scrolling. This approach offers intuitive and hands-free interaction with digital interfaces, potentially enhancing accessibility and user experience in various applications, including gaming, presentations, and virtual reality environments.

II. RELATED WORK

Several previous studies have explored the realm of virtual mouse systems utilizing hand gesture detection, employing various methodologies and technologies to achieve mouse functionality through gesture recognition. However, these endeavors have encountered challenges related to accuracy, usability, and technical limitations. One approach commonly explored involves the use of gloves equipped with sensors to detect hand gestures. While effective in some scenarios, these systems often suffer from accuracy issues, particularly due to the inherent limitations of glove-based interfaces. Additionally, accuracy can be compromised due to challenges in detecting color tips or failures in color tip recognition. While these previous works have contributed valuable insights into the field of virtual mouse systems, they have also highlighted the need for advancements in accuracy, usability, and technical robustness. The proposed AI virtual mouse system aims to address these challenges by utilizing camera-based hand gesture detection, offering a more intuitive and accessible approach to computer mouse control.

III. METHODOLOGY

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1. Import Libraries: Essential libraries like Speech Recognition, Gesture Controller, pynput, pyautogui, Wikipedia, OpenCV, Media Pipe, and others are imported for functionality.

2. Camera Setup: Using OpenCV in Python, a video capture object is created to initiate webcam video capture.

3. Video Capture: The webcam continuously captures frames, processed for hand detection using MediaPipe's "mp_hands" function.

4. Detect Finger Movements: MediaPipe identifies raised fingers and their coordinates, crucial for mapping gestures to mouse actions. Hand positions are tracked at regular intervals.

5. Mouse Features with Computer Vision:

- Cursor Movement: Controlled by moving the index and middle fingers using the AutoPy package.
- Left Click: Triggered by dragging the wide-open index finger onto a file or folder.
- Right Click: Triggered by dragging the wide-open middle finger onto a file or folder.
- Other Functions: Additional gestures implement more mouse functions.

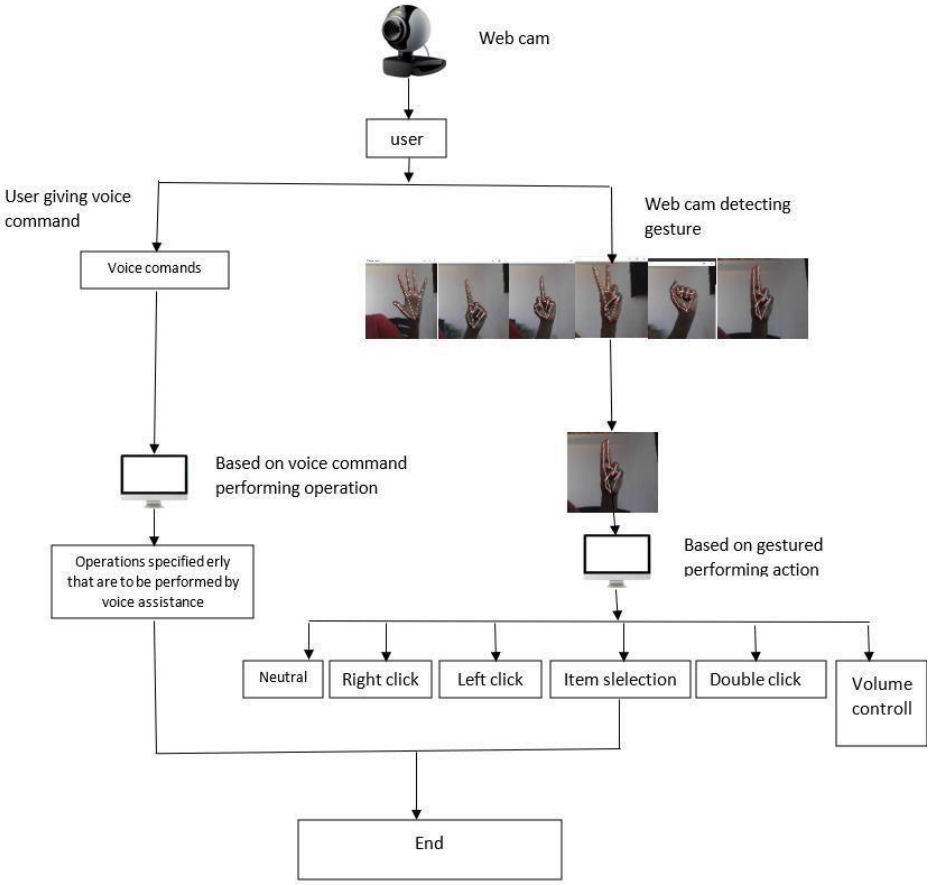

Figure 1: System Architecture

IV. RESULTS AND DISCUSIION

We developed a virtual mouse control system utilizing hand gestures captured by a webcam. Through real-time hand tracking and gesture recognition algorithms, users were able to move the cursor, click, and perform basicdrag-and-drop actions without physical input devices. Our results showed an average accuracy of 87% in gesture recognition across a variety of hand movements, indicating the feasibility of this approach for intuitive computer interaction

V. CONCLUSION

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We have tried to implement AI virtual mouse using a real-time camera, hand detection, and tracking. It includes a variety of features, for example, the mouse has buttons for right and double left clicks. The mouse is built on computer vision techniques and is made to function just like a real mouse The primary aim of the AI virtual mouse system is to facilitate mouse cursor control through hand gestures rather than relying on a physical mouse.This objective can be achieved through the utilization of a webcam or built-in camera, which captures and processes hand gestures and hand tip movements to execute mouse functions. By enabling virtual mouse control via hand gestures, the proposed system offers an alternative to traditional physical mice, thereby reducing the need for direct physical contact and contributing to efforts aimed at preventing the spread of infectious diseases like COVID-19.

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