Controlling laptop working with hand gestures

Kaustubh Naithani
20BCS4000
20bcs4000@cuchd.in
Chandigarh University
Mohali,Punjab
India

Dhruva Malik
20BCS3976
20bcs3976@cuchd.in
Chandigarh University
Mohali,Punjab
India

Prashant Kumar
20BCS4363
20bcs4363@cuchd.in
Chandigarh University
Mohali,Punjab
India

Mohammed Bilal
20BCS3994
20bcs3994@cuchd.in
Chandigarh University
Mohali,Punjab
India

Dr Monika Singh
Chandigarh University
Mohali,Punjab
India

Abstract

In Human-Computer Interaction (HCI), the traditional mouse, a remarkable invention in computer technology, encounters limitations in modern Bluetooth and wireless models due to battery dependence and PC connectivity via dongles. These challenges are tackled by the proposed AI-driven gesture-based virtual mouse. By capturing hand movements via a camera, this innovation employs gestures as a potent communication mode. It allows the computer to replicate functions like left and right-click, scrolling, and cursor control without a physical mouse, aiding in COVID-19 prevention and reducing bias in computer control. This system, integrated with voice commands and utilizing ML and Computer Vision algorithms, eliminates extra hardware requirements, enhancing accessibility and user interaction in diverse environments.

Keywords :- Human Computer Interaction (HCI), Webcam, OpenCV, Mediapipe , CNN, Virtual Mouse.

I. Introduction

Computers have seamlessly integrated into our daily routines, simplifying human-computer interaction (HCI). However, individuals with disabilities face distinct challenges in utilizing these devices effectively. This study introduces a gesture-based AI virtual mouse system, leveraging computer vision to edxecute mouse tasks using hand movements and fingertip detection. The system's core objective is to replace the conventional mouse with a web or built-in camera, enabling cursor control and scrolling through hand gestures.

Python, along with the OpenCV computer vision library, forms the foundation of the gesture-based AI virtual mouse framework. MediaPipe aids in tracking hand and fingertip positions, while Autopy facilitates window navigation, left and right clicking, and scrolling actions. Notably, the model demonstrates exceptional accuracy and efficacy, particularly on CPU-based systems, extending its practicality to real-world scenarios.

Hand gestures are universally recognized as a potent form of human expression. This project taps into this natural mode of communication, proposing a low-cost USB web camera setup for input. The paper introduces a real-time hand gesture system, incorporating techniques such as preprocessing, background subtraction, and edge detection to achieve effective gesture segmentation. By employing the Python language and OpenCV, the AI virtual mouse system is crafted, further enhanced by MediaPipe, Pynput, Autopy, and PyAutoGUI packages for precise hand tracking, cursor movement, and diverse operations.

This paper presents a comprehensive approach to bridging accessibility gaps through a gesture-driven AI virtual mouse, ushering in a new era of intuitive human-computer interaction [1].

II. LITERATURE SURVEY

Existing System

The Virtual Mouse Control System, employing colored fingertip detection and hand gesture recognition, enables cursor manipulation without requiring direct physical contact or sensors. This approach involves identifying vibrant fingertip colors and tracking their movements, with the potential to substitute different hand gestures for colored caps. The system facilitates a range of mouse functions, including scrolling, single and double-clicking on the left side, and more. Diverse arrangements of colored caps cater to various tasks, adapting to different users and lighting conditions. The system's adaptability is demonstrated by adjusting skin tone detection based on the user and environment. By analyzing program output during hand motions, the unused area within the hand's convex hull is approximated. In well-lit settings like offices, where brightness ranges from 500 to 600 lux, colors like Red, Green, and Blue exhibit around 90% detection accuracy. The system overcomes these challenges by incorporating hand gesture recognition technology that detects hand contours, effectively enabling mouse operations through colored fingertips. This system comprises two main methods: finger detection via colored fingertips and gesture recognition. It employs video processing and background subtraction, leveraging colored finger caps for detection, followed by color and circle identification [2]. The recognized gestures trigger various mouse actions. In essence, the Virtual Mouse Control System revolutionizes hands-free cursor manipulation through colored fingertip tracking and hand gesture interpretation, significantly enhancing user interaction and accessibility[3].

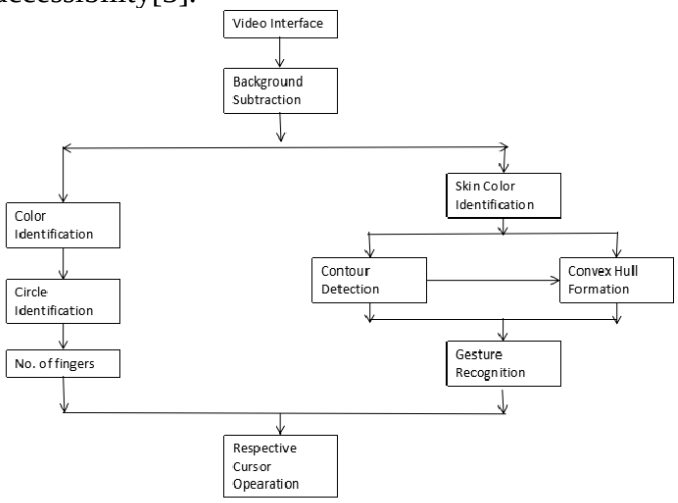

Fig : - Virtual Mouse Control using Colored Fingertips and Hand Gestures Recognition

Proposed System

Creating a hardware-independent virtual mouse eliminates the need for additional equipment and colored fingertip markers. Instead, our approach utilizes the existing web camera on the user's device to capture real-time feeds. The system's workflow commences by initiating the video interface through the device's web camera. Subsequently, the system detects hand gestures, facilitating mouse interaction and executing diverse cursor operations. This virtual mouse solution is characterized by its portability, user-friendliness, and affordability.

The system incorporates "Mediapipe" technology, specifically its hand landmark detection functionality. Mediapipe, developed by Google, is a versatile toolkit that empowers applications with AI-driven features such as hand tracking and gesture recognition. This integration enhances the virtual mouse's capabilities and precision, contributing to an improved user experience [4][5].

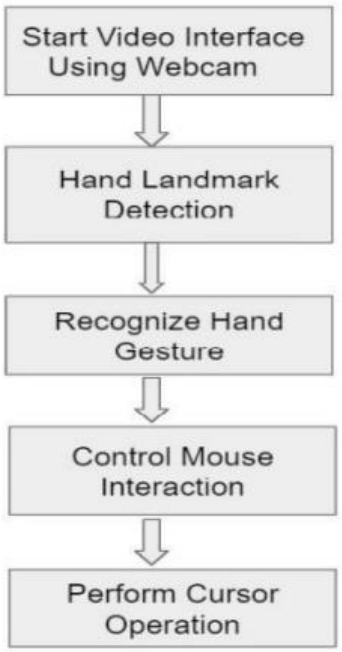

Fig : - Virtual mouse using hand gesture recognition

III. Methodology

IV. Results and Conclusions

V. Future Scope

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