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AIR GAZE GESTURES

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ABSTRACT: This paper presents a real-time hand gesture recognition system utilizing computer vision techniques and machine learning algorithms. The system leverages the Media Pipe and Open CV libraries to detect hand landmarks and track hand movements from live webcam feeds. Through advanced image processing and feature extraction, the system accurately identifies hand gestures, such as single-click, double-click, right-click, and dragging motions. Additionally, the system simulates mouse cursor movements and actions based on the recognized gestures, enabling intuitive interaction with graphical user interfaces. The proposed approach offers a cost-effective and accessible solution for gesture-based control, with potential applications in human-computer interaction, accessibility, and immersive computing environments.

KEYWORDS: Hand gesture recognition, Computer vision, Machine learning, Media Pipe, Open CV, Webcam, Mouse control, Human-Computer interaction, Gesture-based interaction, Real-Time processing.

I. INTRODUCTION

A. Introduction to Gesture-Based Interaction

The emergence of gesture-based interaction has revolutionized the way humans interact with technology, offering a natural and intuitive approach to control devices and interfaces.

B. Overview of air gaze gesture control

Among various gesture recognition systems, air gaze gesture control stands out as a promising technology that allows users to interact with digital interfaces using hand gestures in the air.

C. Technology Behind air gaze Gesture Control

By leveraging computer vision and machine learning techniques, air gaze gesture control systems can accurately detect and interpret hand movements captured by a webcam or other sensors, enabling seamless navigation and interaction without physical touch or input devices.

D. Enhancing User Experience

Air gaze gesture control systems hold immense potential for enhancing user experience across a wide range of technological platforms. These systems enable users to perform fundamental mouse operations such as clicking, scrolling, and dragging, as well as advanced functionalities including volume and brightness adjustment, tab switching, and desktop navigation.

E. Challenges and Solutions

Gesture-based interaction revolutionizes tech interaction. Air gaze stands out, enabling hand gesture interaction. Leveraging computer vision, it enhances UX, accessibility, despite challenges.

II. RELATED WORK

Prior research in hand gesture recognition using computer vision and machine learning techniques, such as convolutional neural networks (CNNs) and deep learning models. Other studies have explored gesture-based interaction in virtual reality environments and gaming applications, highlighting the importance of accurate gesture recognition and real-time responsiveness. Additionally, research on human-computer interaction (HCI) has investigated the usability and user experience aspects of gesture control systems, focusing on factors like gesture complexity, fatigue, and user preferences. Studies in assistive technology have also explored the potential of gesture recognition for enhancing accessibility and enabling hands-free interactions for individuals with disabilities are included

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III.METHODOLOGY

WEBCAM:

A webcam capture object using OpenCV's VideoCapture function, specifying the index of the webcam device (usually 0 for the default webcam). It then reads frames from the webcam feed in a loop, flipping the frames horizontally to ensure correct orientation and resizing them to a predefined resolution using OpenCV's flip and resize functions, respectively. It enables to capture the video frames from the webcam, facilitating hand gesture detection and mouse control functionalities.

Display the frame:

The inShow() may be a function of HighGui and it's required to call the waitKey regularly. The processing of the event loop of the inshow() function is finished by calling waitKey. The function waitKey() waits for key.

MOUSE MOVEMENTS:

1. Cursor Movement:

The code translates hand gestures detected from the webcam into cursor movements on the screen. These movements are achieved by mapping the spatial positions of hand landmarks to corresponding positions on the screen.

2. Click Actions:

Single Click: A specific hand gesture, such as bringing the thumb tip close to the index finger, may be recognized as a single click action. When detected, the code simulates a left-click event by sending appropriate signals to the operating system.

Double Click: Similarly, a double-click gesture, often characterized by two quick successive hand movements, can be recognized and translated into a double-click action on the screen.

Right Click: Certain hand gestures, such as bringing the thumb tip close to the middle finger, may trigger a right-click action, simulating a right-click event on the screen.

3. Dragging:

The code allows for dragging actions through hand gestures. By tracking the movement of the hand landmarks, the system can detect dragging gestures, such as moving the hand while keeping the index finger extended, and translate them into dragging actions on the screen.

4. Press and Release:

In addition to click actions, the code may also recognize press and release gestures. For example, pressing the thumb and index finger together may indicate a press action, while releasing them may signify a release action

IV. EXPERIMENTAL RESULTS

Figures shows the results of air mouse operations performed using the air gaze gestures. It includes dragging single click, screen adjust, double click, right click and press& release.

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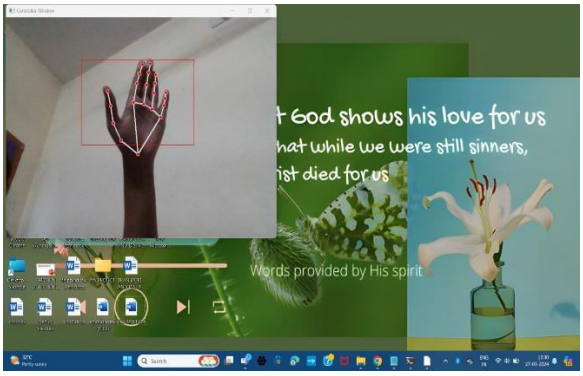
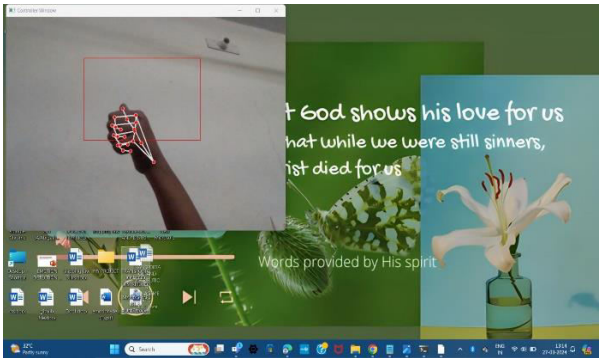


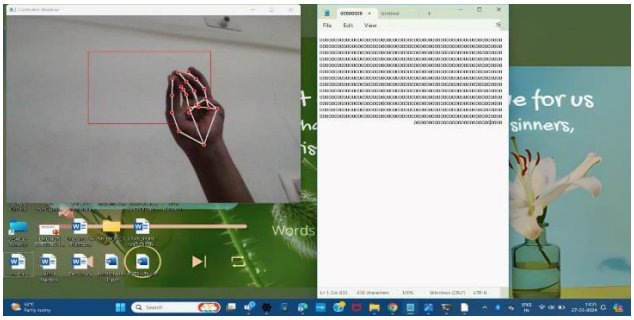
(a)

Fig(a) Dragging



(b)

Fig.(b) Single click



(c)

Fig.(c) Screen adjust

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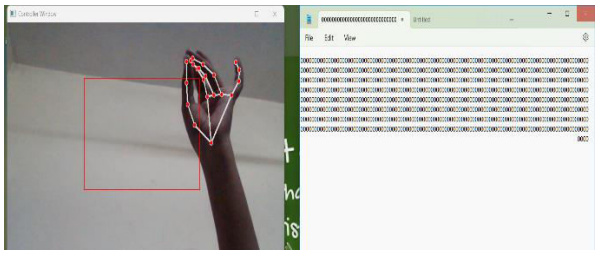
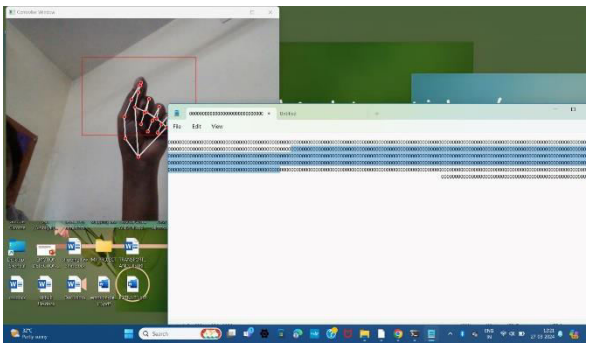
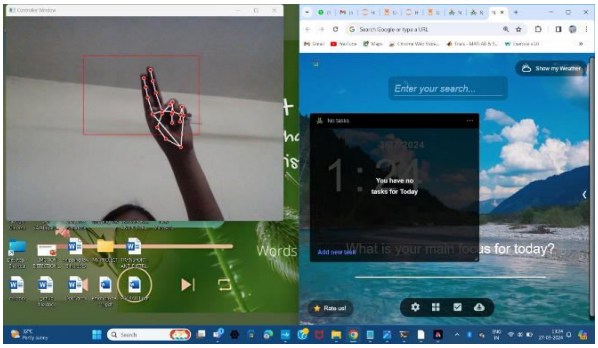


(d)
Fig.(d) press and release



(e)
Fig. (e) Right click



(f)
Fig. (f) double click

V. CONCLUSION

It demonstrates the implementation of a hand gesture recognition system using a webcam for mouse control. By leveraging computer vision techniques and libraries such as Media Pipe and Open CV, the code captures real-time video frames from the webcam, detects hand landmarks, and recognizes specific gestures performed by the user. These gestures are then translated into corresponding mouse movements and actions, allowing for intuitive interaction with digital interfaces without the need for physical touch or input devices.

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