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Gesture Control Virtual Mouse with Voice and Alphabet Typing Support

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Abstract: *This paper presents a Gesture Control Virtual Mouse with Voice and Alphabet Typing Support system that enables users to interact with computers without using traditional hardware such as a mouse or keyboard. The system uses a webcam to detect hand gestures and control cursor movement, clicking, and scrolling operations. In addition, voice commands allow users to perform actions and type text using speech recognition. Alphabet gesture recognition enables users to type characters through hand signals. The system is developed using MediaPipe for hand tracking, OpenCV for image processing, and speech recognition for voice input. The proposed solution provides a contactless and natural human–computer interaction method, which is especially useful for assistive technologies, healthcare environments, and smart systems. Experimental results show that the system works effectively under normal lighting conditions and provides an efficient alternative to traditional input devices.*

Keywords: Gesture Recognition, Virtual Mouse, Hand Tracking, Voice Recognition, Human–Computer Interaction (HCI)

I. INTRODUCTION

Human–Computer Interaction (HCI) has evolved significantly with the development of artificial intelligence and computer vision technologies. Traditional input devices such as keyboards and mice require physical contact, which may not always be convenient or accessible for all users. Gesture recognition and voice control technologies provide a natural and contactless way of interacting with computers.

The Gesture Control Virtual Mouse with Voice and Alphabet Typing Support system allows users to control computer functions using hand gestures captured through a webcam and voice commands through a microphone. The system uses computer vision techniques to detect hand landmarks and recognize gestures that correspond to different mouse actions. In addition, alphabet gesture recognition enables users to type characters using hand signals, while voice typing allows speech-to-text conversion. This system improves accessibility for physically disabled users and provides a hygienic interaction method in environments such as healthcare facilities and laboratories.

II. METHODOLOGY

The system follows a series of steps to convert gestures and voice input into computer actions.

First, the webcam captures live video frames of the user's hand. The frames are processed using OpenCV to detect hand regions. MediaPipe is used to identify hand landmarks and track finger positions.

Next, a machine learning model analyzes the hand landmarks and classifies the gesture. Each recognized gesture is mapped to a specific mouse operation such as cursor movement, clicking, dragging, or scrolling.

For voice typing, the microphone captures the user's speech and the Speech Recognition library converts the speech into text using a speech-to-text algorithm. The recognized text is automatically typed into the active application using keyboard automation.

In addition, the system includes a face recognition module that verifies the user's identity before granting access to the system.

III. SYSTEM ARCHITECTURE

The system architecture consists of three main components: input devices, processing modules, and output actions.

Input Devices

- Webcam for capturing hand gestures and facial images
- Microphone for capturing voice commands

Processing Modules

- Hand gesture detection using MediaPipe.
- Gesture classification using machine learning model
- Speech recognition for voice typing
- Face recognition for user authentication
- Image processing using OpenCV

Output Actions

- Cursor movement
- Mouse clicking and scrolling
- Text typing
- Voice feedback to the user

The system processes input data in real time and converts it into corresponding computer actions.

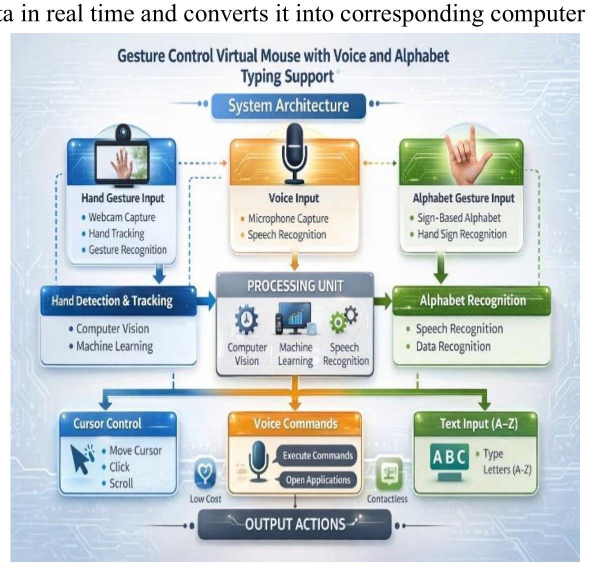

Fig. 1. Gesture Control Virtual Mouse with Voice and Alphabet Typing Support System Architecture

IV. WORKING OF MODULES

A. Virtual Mouse Module

The virtual mouse module detects hand gestures using a webcam and converts them into mouse operations such as cursor movement, clicking, dragging, and scrolling.

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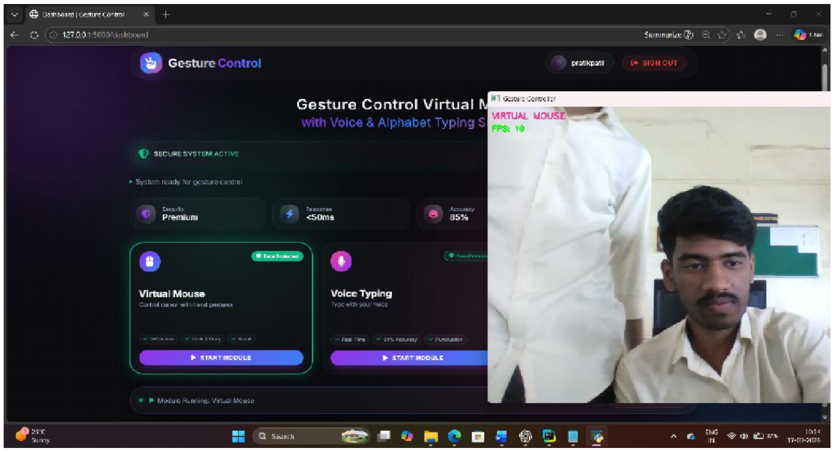

Fig. 2. Working of Virtual Mouse

B. Alphabet Typing Module

This module allows users to type letters by showing specific hand gestures representing alphabets. A trained machine learning model identifies the gesture and types the corresponding character.

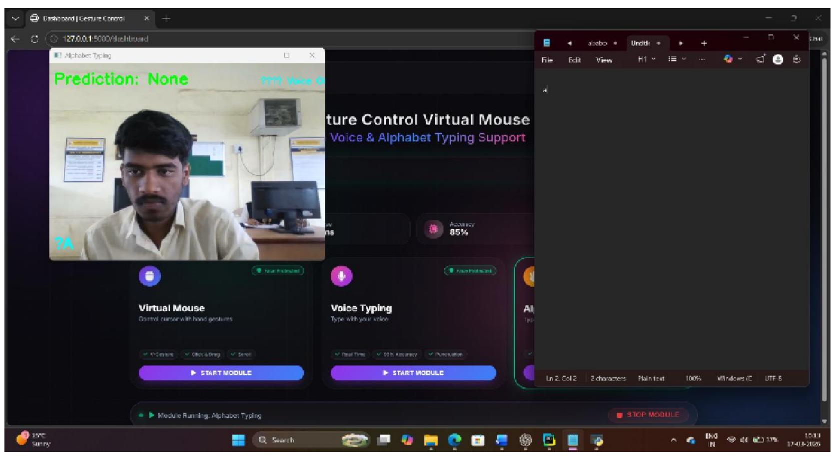

Fig. 3. Working of Alphabet Typing

C. Voice Typing Module

The voice typing module converts spoken words into text using speech recognition techniques and automatically types the recognized text in the active text editor.

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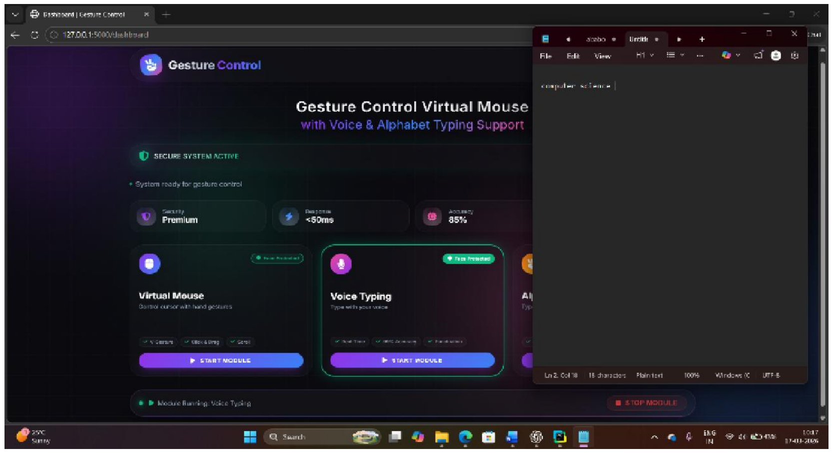

Fig. 4. Working of Voice Typing Module.

V. SNAPSHOTS

A. Dashboard Page

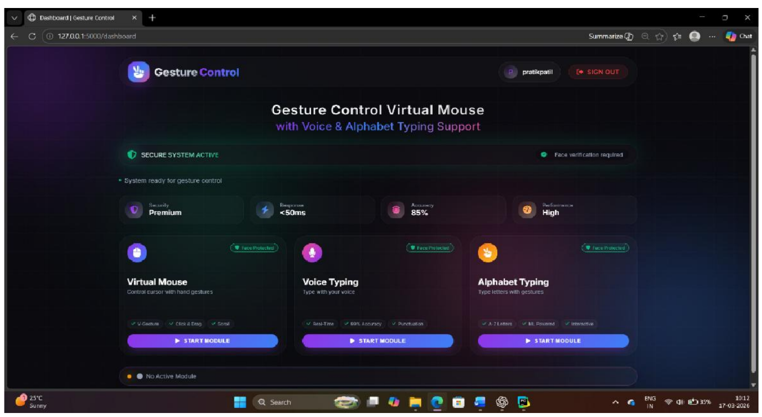

Fig. 5. Dashboard Page

B. Login Page

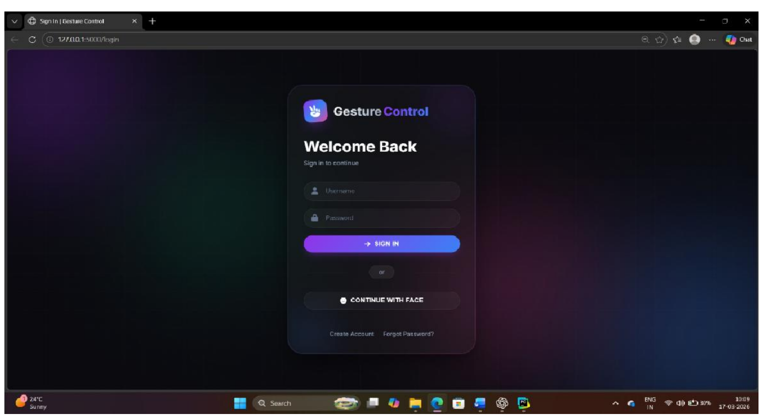

Fig. 6. Login Page

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C. Registration Page

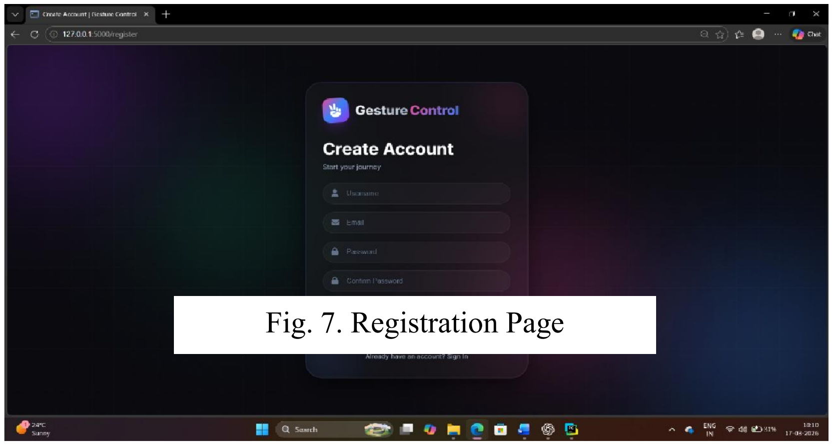

Fig. 7. Registration Page

D. Password Recovery / Forgot Password Page

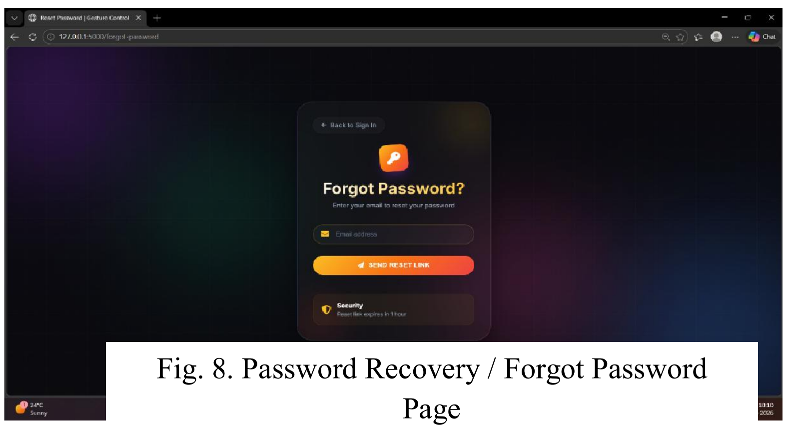

Fig. 8. Password Recovery / Forgot Password Page

VI. RESULT AND DISCUSSION

The developed system successfully demonstrates a contactless method of interacting with a computer using hand gestures and voice commands. The virtual mouse module effectively detects hand gestures and performs mouse operations such as cursor movement, clicking, and scrolling. The voice typing module accurately converts spoken words into text, reducing the need for manual typing. The alphabet gesture typing module allows users to type characters using hand gestures. The face recognition module ensures secure authentication of users. The system performs effectively under normal lighting conditions and standard webcam quality.The system achieved good accuracy under normal lighting conditions.

VII. APPLICATION

- Assistive technology for disabled users
- Healthcare environments requiring contactless interaction, education and smart classrooms
- Office automation systems
- Gaming and virtual reality applications
- Home automation and smart systems

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VIII. FUTURE ENHANCEMENT

Future improvements can include integrating deep learning algorithms to improve gesture recognition accuracy. Multi-language voice recognition can make the system more accessible to users from different regions. The system can also be extended to support mobile devices and smart home automation systems. Advanced sensors such as depth cameras can improve performance in low-light environments. Personalized gesture profiles and adaptive learning techniques can further enhance system usability.

IX. CONCLUSION

The Gesture Control Virtual Mouse with Voice and Alphabet Typing Support system provides an innovative and efficient solution for touchless human-computer interaction. By combining computer vision, machine learning, speech recognition, and face authentication technologies, the system allows users to control computer functions using natural gestures and voice commands. The system improves accessibility, usability, and convenience in various environments including healthcare, education, and office settings. With further enhancements, this technology has the potential to become an important part of future human-computer interaction systems.

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