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GESTURE CONTROLLED VIRTUAL MOUSE

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Abstract: With the rapid advancement of Artificial Intelligence and Computer Vision, Human-Computer Interaction (HCI) is evolving towards more intuitive and contactless systems. Traditional input devices such as mouse and keyboard require physical interaction, limiting flexibility and accessibility. This paper presents a Gesture Controlled Virtual Mouse system that enables users to control computer operations using hand gestures and voice commands without physical contact. The system uses MediaPipe for real-time hand tracking, OpenCV for image processing, and Speech Recognition for voice-based interaction. It allows users to perform actions such as cursor movement, clicking, scrolling, and application control. The proposed system provides a flexible and efficient alternative to traditional input devices by combining gesture recognition with voice control. It ensures better user interaction, improved accessibility, and seamless integration into modern computing environments.

Keywords—Gesture Recognition, Virtual Mouse, Computer Vision, MediaPipe, OpenCV, Speech Recognition, Human Computer Interaction

I. INTRODUCTION

Human-Computer Interaction (HCI) has evolved significantly with advancements in Artificial Intelligence and Computer Vision. Traditional input devices such as keyboards and mice require physical interaction, which can be inconvenient and less efficient in modern computing environments.

With the increasing demand for touchless systems, gesture recognition has emerged as an effective solution. It allows users to interact with computers using natural hand movements without physical contact. Additionally, voice assistants further enhance interaction by enabling users to perform operations through speech commands. The Gesture Controlled Virtual Mouse system combines hand gesture recognition and voice control to provide a more intuitive and efficient interface. The system uses computer vision techniques to track hand movements and convert them into cursor actions such as movement, clicking, scrolling, and dragging. The main objective of this system is to improve accessibility, reduce dependency on traditional input devices, and provide a modern, contactless way of interacting with computers.

II. METHODOLOGY

The project uses a method that includes capturing real-time video input, processing it using computer vision techniques, and executing corresponding actions. The system uses a webcam to continuously capture hand movements. The processing unit uses MediaPipe for hand landmark detection and OpenCV for analyzing these gestures to perform operations such as cursor movement, clicking, scrolling, and drag-and-drop. At the same time, a voice recognition module is used to capture and process voice commands through a microphone. The Speech Recognition system converts speech into text and executes commands such as opening applications, performing searches, and controlling system functions. Both gesture and voice modules work together in real-time to provide a smooth and efficient user experience without the need for physical interaction with input devices.

III. LITERATURE REVIEW

Various research studies have explored gesture-based human-computer interaction using computer vision techniques. MediaPipe, developed by Google, has been widely used for real-time hand tracking due to its accuracy and efficiency. OpenCV is commonly used for image processing and gesture recognition tasks. Several systems have been proposed to replace traditional input devices using hand gestures. These systems use cameras to detect hand movements and convert them into control commands. Similarly, voice assistants using Speech Recognition APIs have been developed to enable hands-free interaction. However, many existing systems either focus only on gesture control or only on voice commands. The proposed system improves upon these approaches by combining both gesture recognition and voice control, resulting in a more flexible and efficient human-computer interaction system.

IV. PROBLEM STATEMENT

Traditional input devices such as mouse and keyboard require physical interaction, which can be inconvenient in many situations such as remote operation, hygiene-sensitive environments, or accessibility scenarios. Existing gesture-based systems often lack accuracy and stability, while voice-based systems alone may not be sufficient for complete system control. Additionally, switching between multiple input methods reduces efficiency and user experience. Therefore, there is a need for a system that combines gesture recognition and voice control to provide a more natural, efficient, and contactless way of interacting with computers.

V. OBJECTIVES OF THE PROJECT

The main objectives of the Gesture Controlled Virtual Mouse system are:
1. To develop a touchless human-computer interaction system using hand gestures.
2. To integrate voice commands for performing system-level operations.
3. To enable cursor control actions such as movement, clicking, scrolling, and dragging using gestures.
4. To improve accessibility for users by reducing dependency on physical input devices.
5. To create an efficient and user-friendly interface for modern computing environments.

VI. TECHNOLOGIES USED

Component	Technology
Programming Language	Python
Computer Vision	OpenCV
Hand Tracking	MediaPipe
Voice Recognition	SpeechRecognition
Text-to-Speech	pyttsx3
Automation Tool	PyAutoGUI

VII. RESULTS

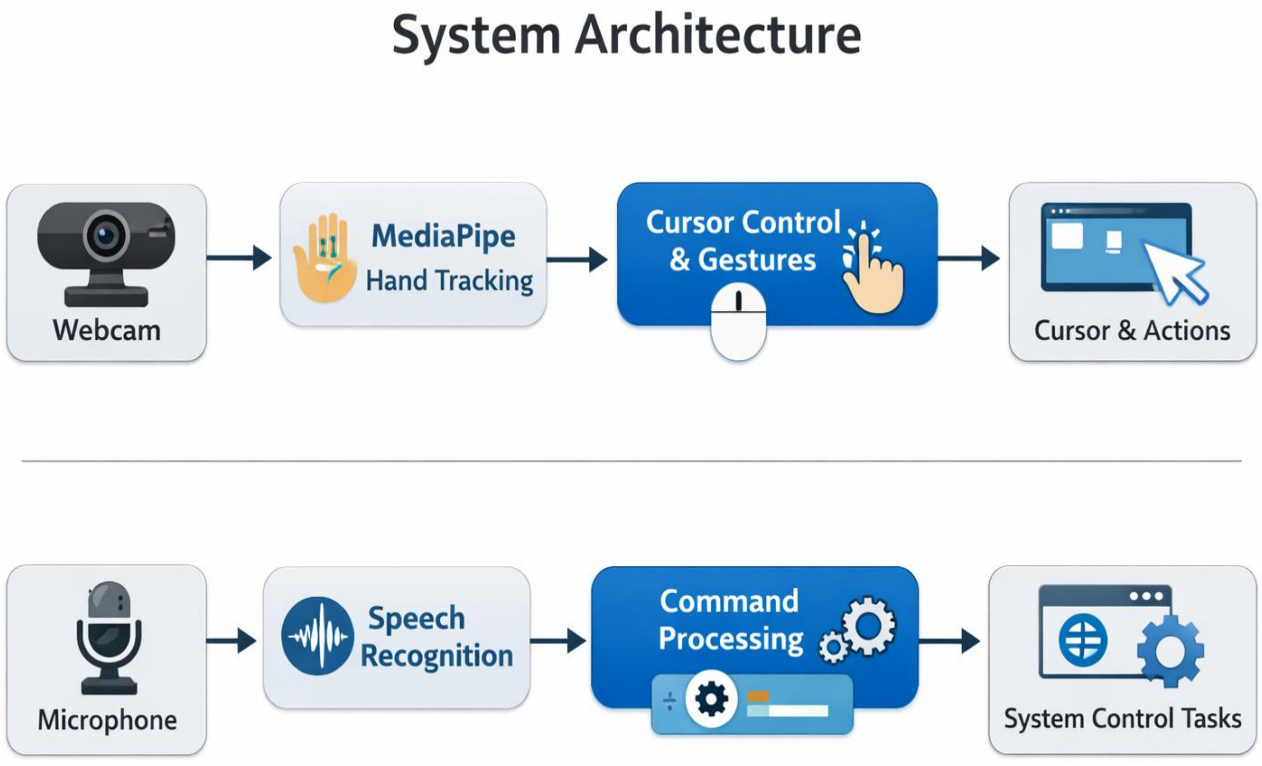
The system successfully performed real-time gesture recognition and voice command execution. The cursor movement was smooth and responsive, and actions such as clicking, scrolling, and dragging were accurately performed using hand gestures. The voice assistant was able to recognize commands with minimal delay and execute tasks such as web search and system control effectively. Overall, the system achieved an accuracy of approximately 90–95% under normal lighting and working conditions, with a response time of around 1–2 seconds.

PROPOSED SYSTEM

A. System Overview

The Gesture Controlled Virtual Mouse system uses a webcam to capture hand movements and a microphone to process voice commands. The system detects hand landmarks using MediaPipe and processes them using computer vision techniques to control cursor movement and perform various actions. In addition to gesture recognition, a voice assistant module is integrated to execute commands such as opening applications, performing web searches, and controlling system operations. The system works in real-time and does not require any additional hardware apart from a standard camera and microphone.

B. System Architecture



VIII. DISCUSSION

The integration of gesture recognition and voice control provides a more flexible and efficient way of interacting with computers. The system reduces the dependency on traditional input devices and offers a modern, touchless interface. However, the performance of the system depends on factors such as lighting conditions, background environment, and camera quality. Similarly, voice recognition accuracy may be affected by noise and internet connectivity. Despite these challenges, the system demonstrates strong potential for improving human-computer interaction in various applications.

IX.ADVANTAGES

- Enables touchless interaction
- Improves accessibility for users
- Reduces dependency on physical devices
- Provides faster and more intuitive control
- Combines gesture and voice interaction

X. LIMITATIONS

- Performance depends on lighting conditions
- Requires a good quality camera and microphone
- Limited set of predefined gestures
- Voice recognition may be affected by background noise
- Depends on internet connectivity for some voice commands

XI. FUTURE ENHANCEMENTS

- Add support for multiple languages in voice commands
- Implement custom gesture training using machine learning
- Improve accuracy using advanced deep learning models
- Integrate with AR/VR systems for immersive interaction
- Extend functionality to mobile and IoT devices

XII. CONCLUSION

The Gesture Controlled Virtual Mouse system presents a modern approach to Human-Computer Interaction by combining gesture recognition and voice control. It eliminates the need for traditional input devices and provides a more natural and efficient way of interacting with computers. The system demonstrates good accuracy and real-time performance under normal conditions. While there are certain limitations related to environment and hardware, the overall performance shows strong potential for future improvements. This project highlights the effectiveness of combining computer vision and voice technologies to create smart, touchless systems suitable for modern computing environments.

XIII. REFERENCES

[1] MediaPipe Documentation

[2] OpenCV Documentation

[3] SpeechRecognition Library Documentation

[4] PyAutoGUI Documentation

[5] Research Papers on Human Computer Interaction