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Hand Gesture Based Presentation Control System

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Abstract: *The Hand Gesture-Based Presentation Control System uses Python, MediaPipe, and OpenCV to enable touch-free slide navigation through real-time gesture recognition. It enhances user experience, accessibility, and hygiene in academic, corporate, and remote settings. By detecting and classifying hand gestures, the system triggers slide changes, offering an intuitive and modern alternative to traditional controls. The system can accurately track hand landmarks and recognize predefined gestures in real- time. Common gestures, such as swiping left or right, are mapped to actions like moving forward or backward in a slideshow. The camera continuously captures hand movements, and the gesture recognition model processes this input to determine the corresponding command*

Keywords: Gesture Recognition, Computer Vision, Presentation Control, hand Gestures, Gesture recognition model

I. INTRODUCTION

In the era of digital transformation, the interaction between humans and machines has evolved significantly. Traditional input devices such as keyboards, mice, and remotes have long been the primary means of controlling digital interfaces. However, as technology advances, there is a growing demand for more natural, intuitive, and contactless methods of communication between users and electronic systems. One such method gaining traction is gesture-based control, which falls under the broader field of Human-Computer Interaction (HCI).

The Hand Gesture Based Presentation Control System is a project aimed at improving the way presentations are controlled by eliminating the need for physical input devices. This system leverages computer vision and machine learning technologies to detect and interpret specific hand gestures using a standard webcam. These gestures are then translated into corresponding keyboard commands to navigate through presentation slides, thereby offering a completely touch-free user experience.

II. NEED OF PROJECT

In today's digital era, traditional methods of presentation control such as using a keyboard, mouse, or remote—are becoming increasingly inadequate, especially in dynamic, hands-free, or hygienic environments. These conventional tools often require physical contact, can malfunction, or may not be accessible to individuals with mobility impairments. With the rising demand for intuitive and touch-free human-computer interaction, there is a clear need for an alternative that is both efficient and user-friendly. The Hand Gesture Based Presentation Control System addresses this gap by offering a contactless solution that leverages real-time hand gesture recognition using computer vision and machine learning techniques. It not only enhances the user experience during presentations but also improves accessibility and reduces reliance on external hardware. This system proves especially valuable in academic institutions, corporate meetings, and remote learning environments where seamless interaction, hygiene, and accessibility are critical factors. It represents a step forward in intelligent, touch-free technology.

III. PROBLEM DEFINITION

Traditional methods of navigating presentation slides—such as using keyboards, mice, or remote clickers are limited by the need for physical contact, proximity, and user attention. These methods can interrupt the natural flow of a presentation, reduce engagement, and pose accessibility challenges for individuals with physical disabilities. Traditional slide navigation methods pose the following challenges:

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- Dependency on physical contact with devices
- Limited accessibility for individuals with physical impairments.
- Disruptions during presentations due to the need to operate controls manually.
- Inconvenience in remote setups or hygienic environments.
- There is a need for an intuitive, contactless, and efficient method to navigate presentation slides, especially in dynamic environments like classrooms, corporate meetings, and virtual sessions.

IV. METHODOLOGY TO SOLVE THE PROBLEM

The development of the Hand Gesture Based Presentation Control System follows a structured and modular approach using Python and computer vision libraries. The process begins with **real-time video capture** through a standard webcam, which continuously streams frames for analysis. These frames are preprocessed using **OpenCV** for noise reduction, horizontal flipping, and grayscale conversion to enhance clarity and simplify background visuals. Next, **MediaPipe Hands** is utilized to detect and track 21 hand landmarks, enabling accurate real-time hand positioning. Using **NumPy**, the system calculates the **distances and angles** between specific landmarks to recognize gestures such as pinching. These gestures are matched against predefined threshold values to classify the command accurately.

Once a gesture is identified, **PyAutoGUI** simulates the corresponding keyboard input (e.g., left or right arrow key) to navigate presentation slides. A responsive and clean **GUI built with CustomTkinter** allows users to control tracking, receive real-time feedback, and access basic usage instructions. To improve reliability, the system includes **adaptive thresholding**, **gesture filtering**, and **performance optimization** mechanisms to reduce false detections and ensure smooth operation under different lighting and environmental conditions. This comprehensive methodology ensures a touch-free, user-friendly, and efficient solution for modern presentation control.

Output:

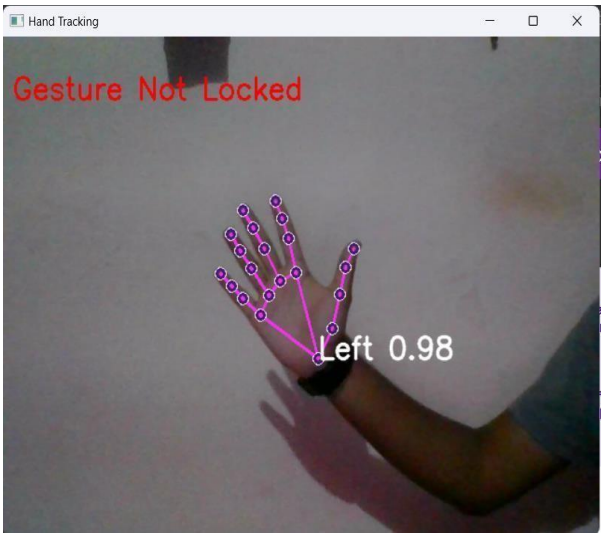

Fig. 1- Hand Detection in Real-Time

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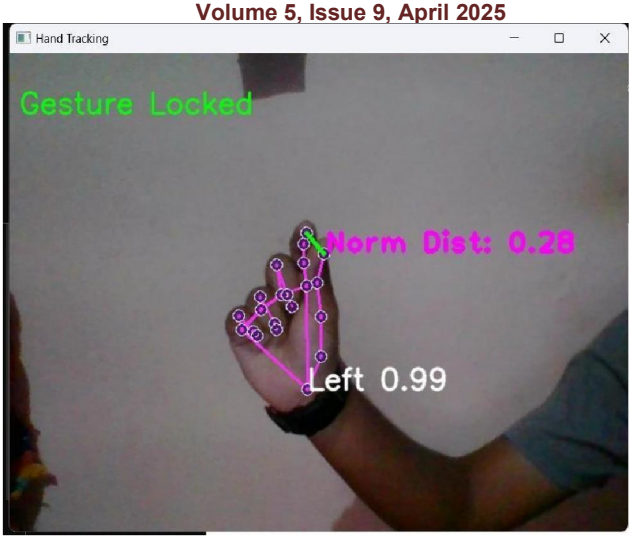

Fig. 2- Gesture Recognization

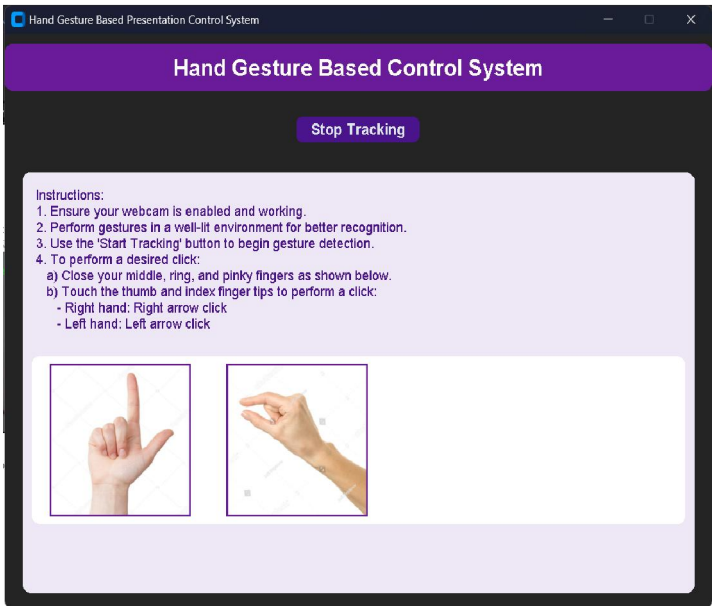

Fig 3- User Interface

V. CONCLUSION

The Hand Gesture Based Presentation Control System stands as a practical and innovative application of computer vision and automation technologies, demonstrating how gesture recognition can enhance human-computer interaction in real-world scenarios. Through the integration of frameworks like MediaPipe for real-time hand landmark detection, OpenCV for image preprocessing, and PyAutoGUI for simulating keyboard controls, the system offers a completely contactless method of navigating presentation slides. This eliminates the need for traditional input devices such as keyboards, mice, or remote clickers, thus providing greater flexibility and convenience during lectures, business meetings, and online sessions.

One of the most significant advantages of this system is its focus on accessibility and hygiene. By removing the requirement for physical touch, the system is particularly useful in environments where minimizing contact is crucial—such as during the COVID-19 pandemic or in clean-room settings. Moreover, individuals with physical disabilities or

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mobility impairments can benefit greatly from a hands-free interface that responds to simple gestures. This increases inclusivity and provides equal opportunity for individuals who might otherwise struggle with traditional input tools.

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