



CENTRE FOR INNOVATIVE STUDIES

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HAND GESTURE RECOGNITION SYSTEM

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Motivation



- To eliminate the need for physical contact with devices during presentations, improving hygiene and convenience.
- To overcome the limitations of traditional tools (mouse, keyboard, remote) that restrict presenter mobility and engagement.
- To leverage advancements in computer vision and machine learning for real-time, intuitive gesture recognition using a standard webcam.
- To create a more interactive and modern presentation experience for classrooms, meetings, and conferences.
- To demonstrate the practical application of open-source technologies in solving real-world problems.

Problem Statement

- Traditional presentation controls like keyboards, mice, and remotes can interrupt the presenter's flow and limit mobility.
- These devices require physical contact, which may not always be convenient or hygienic, especially in shared environments.
- There is a need for a more natural, touchless, and intuitive way to control and annotate presentations.
- The project aims to solve this by developing a real-time hand gesture recognition system that enables seamless, contactless slide navigation and annotation, enhancing both accessibility and user engagement.



Proposed Methodology

- **Hand Detection:** Use a webcam and computer vision to detect and track the user's hand in real time.
- **Gesture Recognition:** Recognize specific hand gestures to control slide navigation and annotation.
- **PDF to Images:** Convert presentation PDF into images for easy slide display.
- **Slide Control:** Use gestures to move to the next/previous slide and to annotate directly on slides.
- **Visual Feedback:** Show live webcam feed and gesture feedback for a user-friendly experience.
- **Smooth Interaction:** Implement delays and checks to avoid accidental triggers and ensure smooth operation.



Experimental Result & Analysis

- The system was tested on a standard laptop with a 720p webcam under various lighting conditions and backgrounds.
- Gesture recognition accuracy ranged from 93% to 96% across all supported gestures, with the highest accuracy for Undo (96%) and the lowest for Exit (93%).
- The average system frame rate was maintained at 28–30 FPS, ensuring smooth and real-time feedback during presentations.
- Users found the interface intuitive and easy to use after a short familiarization period, with positive feedback on touchless control and hygiene.
- Sometimes, if users held gestures for a long time, their hands got tired, and if fingers were too close together, the system could make mistakes.



Conclusion

- The hand gesture-based presentation control system provides an innovative, touchless solution for navigating and annotating slides.
- It enhances user experience by making presentations more interactive, intuitive, and accessible.
- Real-time gesture recognition ensures smooth operation and immediate feedback.
- This approach demonstrates the potential of computer vision and AI to improve everyday tasks and can be extended to other human-computer interaction applications in the future.



References

- [OpenCV Documentation](#)
- [cvzone.HandTrackingModule Documentation](#)
- [NumPy Documentation](#)
- [PyMuPDF \(fitz\) Documentation](#)
- [Python Official Documentation](#)
- Research papers and articles on hand gesture recognition and human-computer interaction
- Online tutorials and resources on computer vision and gesture-based interfaces

Thank
You!