SYNOPSIS

Project Title : Cursor In Your Hands

1. Abstract

The Gesture Mouse project aims to develop a human-computer interaction system that enables users to control a computer mouse using hand gestures. Leveraging computer vision techniques and deep learning models, the system tracks and interprets hand movements captured through a webcam to perform mouse functions such as cursor movement, clicks, and scrolling. This innovation reduces reliance on traditional input devices, providing an intuitive and touch-free user experience. The solution is particularly beneficial for individuals with physical disabilities or for use in sterile environments where touchless interaction is critical.

2. Introduction

The project titled "Cursor in Your Hands" utilizes MediaPipe, OpenCV, and PyAutoGUI to implement hand gesture-based control of a computer cursor. It uses a webcam to track hand landmarks in real-time, enabling users to move the cursor, perform left and right clicks, and simulate drag-and-drop actions using natural gestures. MediaPipe provides robust hand tracking, OpenCV facilitates real-time video processing, and PyAutoGUI enables interaction with the operating system's cursor functions.

This project lies in the field of Computer Vision and Human-Computer Interaction (HCI). It bridges the gap between traditional input devices like a mouse and gesture-based controls, opening up avenues for intuitive and touchless control mechanisms.

3. Motivation

The rise of touchless technologies in a post-pandemic world underscores the need for innovative and hygienic interaction methods. Traditional input devices like mouse and keyboards are often shared and can serve as vectors for disease transmission. Gesture-based systems provide an intuitive and contact-free alternative, which is particularly valuable in public or shared computing environments.

This project demonstrates the potential of affordable hardware (a webcam) combined with modern AI techniques to create a powerful, low-cost, and accessible interaction solution. By leveraging hand gestures, users can interact with their computers seamlessly, enhancing user experience and accessibility, particularly for individuals with limited mobility or dexterity.

4. Objectives

1. To develop a system that tracks hand gestures in real-time using a webcam and MediaPipe.

2. To enable cursor movement and basic mouse operations like left-click, right-click, and drag-and-drop using natural gestures.

3. To provide a touchless and hygienic interface alternative to traditional input devices, enhancing accessibility and ease of use.

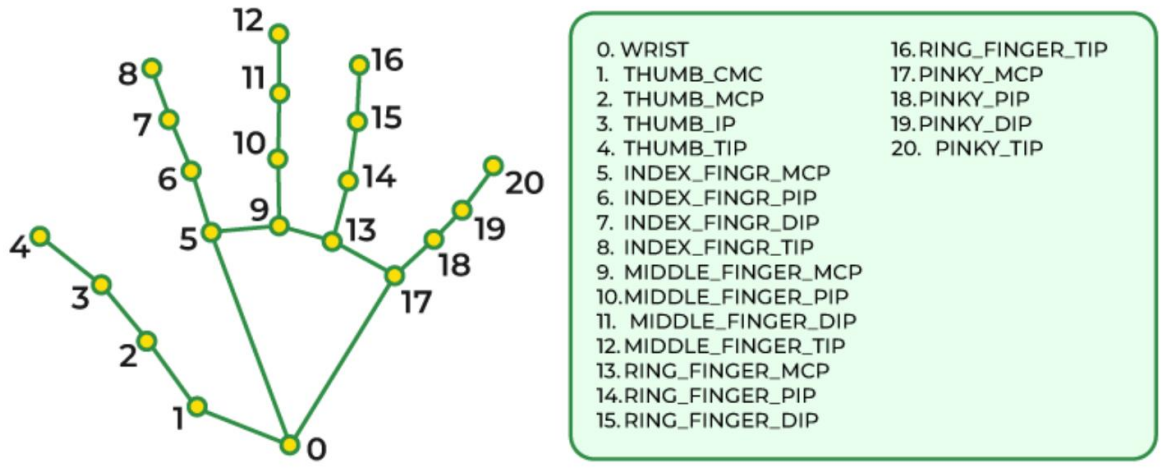

Fig 1.1 : Hand landmark detection using Media Pipe

5. Literature Review

S/No.	Author(s), Journal Name, Year of Publication (YOP)	Title	Problem Identified	Dataset used/ Description	Method(ology) Used	Observations (Strengths, Limitations)
1	Kumar, S., IJARCCE, 2024	AI Virtual Mouse System Using Hand Gestures	Challenges in hands-free interaction for traditional input devices	Custom dataset with webcam-captured hand gestures	OpenCV and MediaPipe for hand tracking and gesture recognition	Achieved 87% gesture recognition accuracy; struggles with complex gestures

2	Patel, M., Rajasekhar, P., IEEE Xplore, 2024	Gesture Controlled Virtual Mouse	Limitations of physical mouse devices in virtual environments	Dataset collected through webcam for gesture tracking	Computer vision and deep learning algorithms for gesture-mouse mapping	High accuracy with simple gestures; reduced performance in low-light conditions
3	Singh, D., Kaur, R., IJARIIE, 2023	AI-Based Virtual Mouse Using Hand Gesture Recognition	Need for alternative input in AR/VR	Real-time camera feed	OpenCV and MediaPipe for real-time gesture detection	Robust tracking; occasional gesture overlap causing incorrect actions
4	Chowdhury, A., Das, B., IEEE Xplore, 2024	Virtual Mouse Input Control using Hand Gestures	Limitations of conventional pointing devices	Custom gesture dataset	CNN for gesture classification in real-time video	Accurate in controlled lighting; struggles with fine gesture distinction

Table 1.1 : Literature Survey

6. Methodology

1. Capture Input: Webcam video feed is acquired.

2. Detect and Track Hands: MediaPipe identifies and tracks hand landmarks.

3. Gesture Recognition: Distances between specific landmarks are calculated to identify left-click, right-click, and drag gestures.

4. Cursor Control: The cursor moves according to the Index Finger Tip’s position.

5. Feedback: Hand landmarks and gestures are displayed on-screen for visual feedback.

6. Exit: User terminates the program by pressing 'q'.

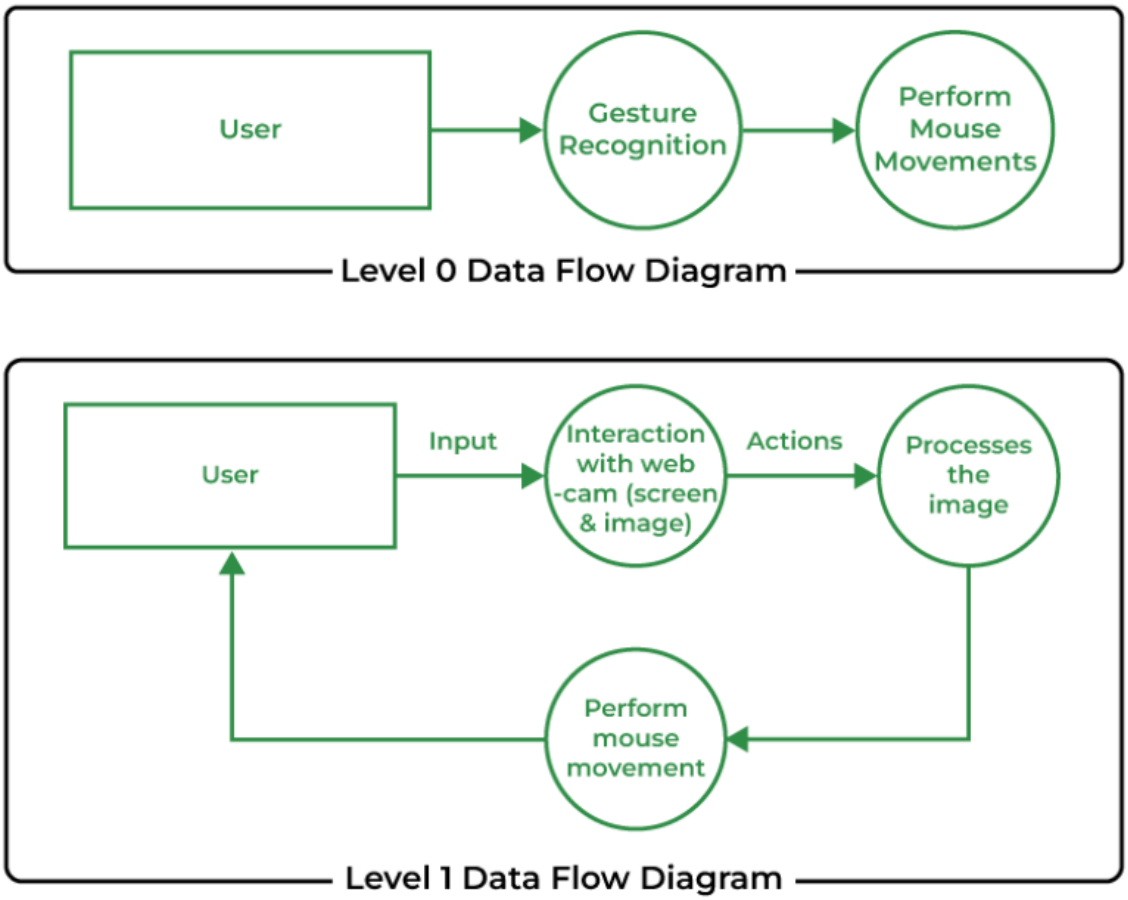

Fig 1.2 : Data Flow Diagram

7. Feasibility Study and Significance

Feasibility Study

- Technical Feasibility: The project uses well-documented and widely supported libraries (MediaPipe, OpenCV, PyAutoGUI), ensuring ease of development and reliability. A standard webcam suffices for hand tracking, making the hardware requirements minimal.
- Economic Feasibility: No specialized hardware is needed beyond a webcam, making the solution cost-effective. Free-to-use libraries further reduce implementation costs.
- Operational Feasibility: The system is intuitive for users, requiring no additional training. It can be deployed on any computer with basic specifications and a webcam.

Significance

- The project enhances human-computer interaction by introducing an intuitive and innovative control method.

- It promotes inclusivity by offering an alternative to traditional input devices, benefiting individuals with physical limitations.
- The touchless nature of the interface ensures hygienic interaction, making it suitable for shared and public computing setups, such as hospitals, banks, and kiosks.

8. References

[1] Kumar, S., IJARCCE, 2024 - http://ijarcce.com

[2] Patel, M., Rajasekhar, P., IEEE Xplore, 2024 - https://ieeexplore.ieee.org

[3] Singh, D., Kaur, R., IJARIIE, 2023 - http://ijariie.com

[4] Chowdhury, A., Das, B., IEEE Xplore, 2024 - https://ieeexplore.ieee.org