# Hand Gesture Controlled Mouse using Python

## 1. Introduction

This project presents a hand gesture-based mouse controller using computer vision. Using a webcam and real-time hand tracking, the system translates gestures into mouse operations such as cursor movement and clicking. The goal is to create a touchless interface using only a standard camera and open-source tools.

## 2. Objective

- To control mouse cursor movement using hand gestures.

- To enable clicking via finger pinch gestures.

- To provide a contactless alternative to traditional input devices.

## 3. Tools and Technologies

| Technology | Purpose |
|---|---|
| Python | Programming Language |
| OpenCV | Video processing |
| MediaPipe | Real-time hand landmark tracking |
| PyAutoGUI | System mouse control |
| NumPy | Array and interpolation logic |

## 4. Working Principle

- The webcam captures live video frames.
- MediaPipe detects and tracks hand landmarks.
- The index finger's tip is used to move the cursor.
- When the thumb and index finger touch, a mouse click is triggered.
- Movements are smoothed using interpolation.

## 5. Features

- Smooth and responsive cursor control

- Natural clicking using pinch gesture

- Real-time webcam feedback

- Cross-platform and lightweight

## 6. Results

| Action | Gesture Detected |
| --- | --- |
| Move Mouse | Index finger tip |
| Left Click | Thumb and Index Finger touching |
| Idle | All fingers lowered |

## 7. Limitations & Future Scope

Limitations:

- Requires good lighting.

- Not suitable for high-speed tasks like gaming.

Future Improvements:

- Add right-click and scroll gestures.

- Support for custom gesture training.

- Multi-hand or multi-user interaction.

## 9. Conclusion

The Hand Gesture Mouse Controller provides an efficient and touchless alternative to traditional mouse devices using simple computer vision techniques. It can be further developed for accessibility, gaming, smart TVs, or remote presentations.