Virtual Mouse Using AI – Project Report

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# Abstract

The Virtual Mouse project uses computer vision and AI to simulate mouse functionality using hand gestures. Using a webcam, the system detects hand landmarks and interprets index finger movement and thumb-index pinches to move the cursor and click, respectively. This project is built using Python, OpenCV, MediaPipe, and PyAutoGUI.

# Introduction

Traditional mouse interfaces are being replaced by gesture-based controls in modern human-computer interaction. This project demonstrates how AI and computer vision can be used to control a virtual mouse in real time, improving accessibility and demonstrating the power of gesture recognition systems.

# Problem Statement

Can we create a real-time, hardware-free mouse controller using only hand gestures and a standard webcam?

# Tools & Technologies

- Python 3.10  
- OpenCV  
- MediaPipe  
- PyAutoGUI  
- Visual Studio Code  
- Webcam

# Working Principle

The webcam captures real-time video, and MediaPipe detects hand landmarks. The index finger's position is used to move the mouse cursor. When the thumb and index finger come close together, it is interpreted as a mouse click.

# Code Snippet

A basic gesture-based click detection:

thumb\_tip = landmarks[4]  
index\_tip = landmarks[8]  
distance = ((index\_tip.x - thumb\_tip.x)\*\*2 + (index\_tip.y - thumb\_tip.y)\*\*2)\*\*0.5  
if distance < 0.04:  
 pyautogui.click()

# Applications

- Accessibility tool for physically impaired users  
- Smart TV or touchless UI  
- Future integration with AR/VR environments

# Future Scope

More gestures can be added for scrolling, drag & drop, or voice integration. This system can also be merged with IoT devices or smart homes for contactless control.

# Conclusion

This project demonstrates the power of computer vision in daily interactions. It proves that with simple tools and AI models, we can enhance usability and build innovative alternatives to traditional input devices.