Project Report

on

Gesture Mouse

Submitted in partial fulfillment of the requirement of the MCA SEM-III

Master of Computer Application (MCA)

at

University of Mumbai

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2023 - 2024

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Certificate of Approval

This is to certify that the Project titled **' Gesture Mouse '** is successfully done by **Nupur Desai , Tushar Askar and Vaibhav Gaikwad** during MCA SEM- III in partial fulfillment of **Master's of Computer Application** under the **University of Mumbai, Mumbai**, through the Bharati Vidypeeth's Institute of Management and Information Technology, Navi Mumbai carried out by her under our guidance and supervision.

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Introduction

1.1 Introduction to Project

Introduction to GestureMouse Project

In the rapidly evolving world of technology, traditional input devices such as the mouse and keyboard remain the primary means of interacting with computers. However, these devices can pose challenges in certain contexts, such as for individuals with physical disabilities, in environments where hygiene is paramount, or for users seeking more intuitive and innovative interaction methods. There is an increasing demand for alternative input methods that provide touchless control, enhance accessibility, and offer a seamless user experience.

GestureMouse is an innovative project designed to address these challenges by enabling users to control their computer mouse using hand gestures. By leveraging computer vision techniques and advanced hand-tracking algorithms, GestureMouse translates specific hand movements into mouse cursor movements and click actions. This touchless interface offers a more natural and accessible way for users to interact with their computers, making it particularly beneficial in various scenarios, including accessibility technology and sterile environments.

The project combines powerful libraries such as OpenCV for real-time image processing, NumPy for efficient numerical computations, and a custom HandTrackingModule for accurate hand landmark detection. Additionally, the pynput library is used to control the mouse programmatically. By integrating these technologies, GestureMouse provides a robust and user-friendly solution for touchless computer interaction, paving the way for innovative user interfaces and enhanced accessibility.

Chapter 2

System Study

1. The GestureMouse project encompasses a blend of computer vision, hand tracking, and mouse control mechanisms to create a touchless mouse interface. This system study outlines the various components, their functionalities, and the interactions between them to provide a comprehensive understanding of the system's architecture and workflow.

2.1 Existing system

In the realm of human-computer interaction, the quest for more intuitive and accessible input methods has been a constant driving force behind technological advancements. Traditional input devices like the mouse and keyboard have served us well for decades, yet they come with inherent limitations. For instance, individuals with physical disabilities may find it challenging to use these devices effectively. In sterile environments, such as healthcare facilities, minimizing touch is crucial to prevent contamination. Moreover, the demand for more natural and immersive ways to interact with digital devices is ever-growing, particularly in fields like gaming, virtual reality, and creative industries.

Recent advancements in computer vision and machine learning have opened new avenues for touchless interaction. By harnessing the power of webcams and sophisticated algorithms, it is now possible to detect and interpret human gestures in real time. This technology has the potential to revolutionize the way we interact with computers, making it more inclusive and adaptable to a variety of contexts.

The GestureMouse project emerges from this landscape, aiming to provide a practical and efficient solution for touchless mouse control. The project leverages OpenCV, a robust library for real-time image processing, to capture and analyze video feeds from standard webcams. It also utilizes NumPy for handling numerical operations efficiently and a custom HandTrackingModule, which employs advanced algorithms to detect and track hand landmarks accurately. This combination allows GestureMouse to translate the position and movements of the hand into corresponding mouse actions.

One of the critical components of GestureMouse is its gesture recognition system, which identifies specific hand gestures to perform mouse click actions. This system is designed to be

responsive and accurate, ensuring that the user experience is smooth and reliable. By mapping the hand's position to screen coordinates, users can control the mouse cursor effortlessly, creating an intuitive interface that can be used in various applications.

GestureMouse is particularly relevant in today's scenario, where touchless technology is gaining traction across multiple domains. In healthcare, for instance, touchless interfaces can reduce the risk of infections. In accessibility technology, they can empower individuals with disabilities to use computers more independently. In creative industries, they can provide a more natural way to interact with digital content, enhancing productivity and creativity.

Through the GestureMouse project, we aim to showcase the potential of touchless interaction and contribute to the development of more inclusive and innovative user interfaces. By addressing the limitations of traditional input devices and exploring new possibilities, GestureMouse represents a significant step forward in the evolution of human-computer interaction.

2.2 Proposed system

GestureMouse is a project designed to let people control their computer mouse using hand gestures instead of a traditional mouse. The system includes several key components working together to achieve this.

First, a webcam captures live video of the user's hand. Using OpenCV, the system processes these video frames to detect and track the hand's movements. A specialized module, HandTrackingModule, identifies important points on the hand, like the fingertips.

Next, the system maps the hand's position from the webcam's view to the computer screen. This means that when you move your hand in front of the camera, the mouse cursor moves correspondingly on the screen.

For clicking actions, the system recognizes specific gestures. By measuring the distance between the index fingertip and thumb tip, it detects when the user is making a click gesture. If the fingertips are close enough together, it simulates a mouse click.

Using the pynput library, the system then moves the cursor and performs click actions based on the hand's movements and gestures. The processed video is displayed on the screen with markers to show where the system detects the hand, providing real-time feedback to the user.

In simple terms, GestureMouse allows users to move the mouse cursor and click on items on their computer screen just by moving their hand in front of a webcam, making computer use more intuitive and accessible, especially for those who might find traditional mouse use challenging.

2.3 OBJECTIVES

1. Develop a Touchless Mouse Control System:

Create a system that allows users to control their computer mouse using hand gestures detected by a standard webcam, eliminating the need for physical touch.

2. Enhance Accessibility:

Provide an alternative input method that is accessible to individuals with physical disabilities, enabling them to interact with computers more easily and independently.

3. Ensure Real-Time Hand Tracking:

Implement real-time hand detection and tracking to ensure smooth and responsive cursor movements that accurately reflect the user's hand movements.

4.Implement Accurate Gesture Recognition:

Develop a reliable gesture recognition system to detect specific hand gestures, such as clicks, ensuring precise and consistent mouse actions.

5. Map Camera Coordinates to Screen Coordinates:

Create an efficient mapping algorithm to translate hand positions from the camera's resolution to the screen's resolution, ensuring accurate cursor placement.

6. Maintain Robustness in Various Environments:

Ensure the system works effectively in different lighting conditions and backgrounds, making it versatile for various use cases and environments.

7. Provide Real-Time Visual Feedback:

Display visual markers on the video feed to show detected hand landmarks and gestures, offering real-time feedback to users for a better interaction experience.

8. Simplify Setup and Use:

Design the system to be easy to set up and use, requiring only a standard webcam and minimal user configuration, making it accessible to a broad audience.

Chapter 3

System Analysis

3.1 Operating tools and technology

Software and Technologies Used for Website Development:

Operating System:

- Windows
- Mac
- Linux

Browser:

- Any modern browser to view the website

Development Environment:

- Integrated Development Environment (IDE): Any Python-compatible IDE such as PyCharm, VSCode, or Jupyter Notebook.

Programming Languages and Libraries:

- Python 3.6 or later: Main programming language for the project.
- NumPy: For efficient numerical computations.
- MediaPipe: For hand detection and tracking.
- pynput: For controlling the mouse programmatically.
- Custom HandTrackingModule: A module built on top of MediaPipe for hand detection and tracking.

Hardware Specifications

- **Processor:** Dual-core or higher
- **RAM:** 4 GB or higher (8 GB recommended)
- **Storage:** Sufficient storage for development tools and project files.
- **Accessories:** Camera-system