

Hand Motions Based Virtual AI Mouse

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Abstract - In recent years, technology has improved the way humans interact with computers. A mouse is an important input device, but traditional wired or wireless mice require extra hardware and may not always be convenient. To solve this problem, this project introduces a virtual mouse system based on hand gestures. The system uses a webcam to capture hand movements and converts them into cursor actions. Different gestures are used for operations like left click, right click, scrolling, and double click. This allows users to control the computer without touching any physical device.

Key Words: HCI (Human-Computer Interaction), HSV (Hue Saturation Value), Hand Gesture, Color Detection, Gesture Recognition.

1. INTRODUCTION

Nowadays, most devices are becoming smaller, smarter, and wireless. In this project, a virtual mouse system is developed using hand gesture recognition. Instead of using a physical mouse, users can control the cursor using their hand movements. The webcam captures the hand gestures and the system processes them to perform actions such as cursor movement, clicking, and scrolling. The system mainly tracks fingertip positions to understand gestures. This method is useful in situations where using a physical mouse is difficult and also helps people with disabilities.

2. SYSTEM ANALYSIS

Existing System:

The existing system uses computer vision techniques to detect hand gestures in real time. A webcam captures the video, and tools like OpenCV process the frames. It detects hand shape and movement to control the cursor. Basic operations like clicking and scrolling are

supported.



Fig-1: flowchart of Existing System

Limitations of Existing Systems:

- Performance depends on lighting conditions
- Background noise may affect accuracy
- Limited gesture options
- Cursor movement may not be smooth

3. PROPOSED SYSTEM

In the proposed system, an improved virtual mouse with an AI-based interface is introduced. Along with normal cursor control, it also provides a virtual keypad on the screen. Users can select keys using gestures. The system uses machine learning to recognize gestures more accurately. Additional sensors help in improving precision and distance detection.

3.1 Working Principle

The system works by capturing video through a webcam. Each frame is processed to detect the hand. After detecting the hand, the system identifies key points such as fingertips and palm position. Around 21 landmark points are used for better tracking. Based on these points, the system recognizes gestures and performs

corresponding mouse actions.



Fig-2: flowchart of proposed System

3.2 functional requirements

1. Input Function (Video Capture):

- The system captures live video through a webcam.
- Each video frame is taken as input.

2. Image Processing Function:

- The captured frames are processed using AI and computer vision.
- The hand region is detected from the image.

3.3 Non functional requirements

Accuracy:

- Hand detection accuracy should be above 90% under proper lighting conditions.
- The Gesture recognition error rate should be minimal.

Reliability:

- The system should operate continuously without crashing.
- If the webcam disconnects, the system should show an error and recover properly.

Advantages of the Proposed System :

- Touch-Free Human Computer Interaction
- Low Cost Implementation
- Easy to Use Interface
- Accessibility Support
- Real-Time Performance

EXPERIMENTAL RESULTS:

- The system was able to detect hand gestures accurately using a standard webcam without requiring any additional hardware.
- The cursor moved on the screen according to the hand movements captured by the camera.

- Mouse operations such as left click, right click, and scrolling were successfully performed using predefined hand gestures.
- The model tracked important hand landmarks within the camera frame.
- Basic computer operations were successfully controlled through simple hand gestures



Fig-1: Screenshot gesture using closed fist



Fig-2: Hand landmark detection with real-time cursor movement



Fig-3: Left-click gesture using thumb and index finger



Fig-4:Right-click gesture using thumb and middle finger

4. CONCLUSIONS

The virtual AI mouse provides a simple and effective way to interact with computers without using physical devices. It improves accessibility and reduces the need for extra hardware. This system is cost-effective and easy to use. It also supports touch-free interaction, which is useful in many applications.

FUTURE SCOPE

In the future, this system can be used in advanced technologies like AR and VR. It can also be combined with voice control and eye tracking for better user experience. With further improvements, gesture-based systems may become common in smart devices and public systems.

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