Facial Features Based Mouse Operation For Amputees And General Purpose

Nanditha S[1], Pavana K[2], Spoorthi S R[3], Vandana H [4], Rajath A N[5]
[1, 2, 3, 4] Dept of CSE
[5]Assistant Professor, Assistant Professor,
[1, 2, 3, 4, 5] GSSSIETW, Mysuru, India

Abstract- *Facial Feature based mouse operation for Amputees and General Purpose is a hands-free computer interaction system using facial landmark detection with dlib and OpenCV. It tracks facial features such as the nose, eyes, and mouth to control the mouse—using nose movement for cursor navigation, eye blinks for clicks, and mouth actions for system activation. Pyautogui simulates mouse operations, offering a seamless alternative to traditional devices. Designed for amputees and users needing touchless control, this system enhances accessibility and demonstrates the potential of facial-feature-based technology in modern human-computer interaction.*

Keywords- Facial Landmark Detection, Hands-Free Control, Human-Computer Interaction.

I. INTRODUCTION

The Facial Feature-Based Mouse Operation project introduces a hands-free way to interact with computers by using facial movements instead of traditional input devices. It's built with accessibility in mind, aiming to help people with physical disabilities or those working in settings where using hands isn't practical—like in medical or industrial environments. Using a regular webcam along with tools like dlib, OpenCV, and pyautogui, the system tracks facial features in real time to perform basic mouse functions such as moving the cursor, clicking, and scrolling.

WorkFlow: The specific facial actions control different mouse functions. For example, opening or closing the mouth turns the system on or off, moving your nose moves the cursor, and blinking the left or right eye triggers a left or right click, respectively. If both eyes are closed, the system enters scroll mode, allowing users to scroll through documents simply by moving their head. The result is a more intuitive and accessible way to interact with computers without touching a mouse.

II. LITERATURE SURVEY

A literature survey is a key part of the software development processs. Before building any tool, it's important to first look at factors like time, budget, and the company's capabilities. Once these are clear, the next step is to decide on the right operating system and programming language for developing the tool.

[1] The camera mouseis a system designed to help people with severe disabilities use a computer by tracking their body movements. It works by using a video camera to follow a specific body part, like the nose or finger, and then moves the mouse pointer based on how that part moves. The system figures out movement by comparing images from one video frame to the next. It has been tested by both people with disabilities—such as those with cerebral palsy or brain injuries—and those without, and it showed encouraging results, allowing users to communicate and navigate online. However, some issues like needing frequent calibration and user fatigue from holding facial positions for a long time were found to affect its performance and comfort.

[2] Human-Computer Interaction Based Head Controlled Mousethis document talks about a head-controlled mouse system that helps people with severe disabilities use a computer by tracking their facial features. It uses a regular webcam to follow a specific part of the face—like the nose or finger—and moves the mouse pointer based on how that part moves. The system, which relies on a tracking algorithm, was tested on both people with and without disabilities and showed it could effectively help users access and communicate through a computer. However, it still has some challenges, like needing accurate setup, struggling in poor lighting, and causing fatigue from holding the head still for long periods. While it's a promising assistive tool, improvements in comfort, tracking accuracy, and usability are needed for it to work well in the long run.

[3] Eye-Controlled Mouse Cursor this paper by Mahalakshmi S, S. Nirmal, and Dr. L. Suriya Kala (2022) introduces a system that lets users control the mouse cursor by

tracking their eye movements in real time. Using advanced image processing, the goal is to make computer use easier for people with limited mobility. The system allows users to do basic tasks like moving the cursor and clicking using just their eyes. However, it still has some challenges, like difficulty detecting small eye movements, needing frequent calibration, and being affected by things like lighting and how still the user keeps their head. The authors suggest that with better sensors and smarter calibration methods in the future, eye-controlled systems could becomemore accurate and widely used as assistive tools.

[4]Machine-Learning-Based Carbon Footprint Management in the Frozen Vegetable Processing Industry The paper by Scherer and Milczarski (2023) explores how machine learning can help reduce the carbon footprint in the frozen vegetable processing industry by making production more efficient. They started by analyzing how different production factors are related, then grouped similar processes into five categories. After that, they tested different machine learning models to find the best ones for improving each group's efficiency, aiming to cut down energy use while keeping production effective. The results showed that using this kind of data-driven approach can lead to big energy savings and lower emissions, making it a promising step toward more sustainable industrial practices. However, the authors highlight that for this to work well, companies need accurate starting data and the ability to adjust in real time.

[5]Real-Time Face and Gesture Recognition for Human-Computer Interaction the article by Wang, Zhang, and Li (2023) introduces a real-time system that lets users interact with computers using their face and hand gestures, instead of a keyboard or mouse. By using deep learning and computer vision, the system can understand facial expressions like smiles or frowns, as well as hand movements like swipes or pointing, to carry out different computer tasks. It's designed to be more user-friendly and helpful, especially for people with physical disabilities. The system works with regular webcams, so it doesn't need any special equipment. However, it does face some issues—like trouble recognizing complex gestures in busy or low-light environments, and it sometimes needs careful setup to work well.

III. METHODOLOGY

Facial Features Based Mouse Operation for Amputees and General Purpose

The diagram illustrates the working of a hands-free mouse control system using facial features. It starts by capturing video through a webcam and detecting facial landmarks using libraries like OpenCV and Dlib. The system tracks specific gestures—such as mouth opening, nose movement, and eye winks—to perform mouse operations like cursor movement, clicking, and scrolling.The PyAutoGUI library is used to simulate actual mouse behavior, offering an accessible and intuitive interface for users with limited mobility.

1.Video Capturing: The system begins by capturing live video of the user's face using a standard webcam. Each frame from the video feed is extracted and sent for facial feature analysis. This real-time input serves as the base for gesture detection.

2.Face Detection:Each captured frame is processed using Dlib and OpenCV to detect the user's face and identify key landmarks. This includes locating the mouth, eyes, and nose, which are essential for interpreting gestures.

3.Mouth Aspect Ratio: The mouth region is analyzed to calculate the Mouth Aspect Ratio (MAR). When the mouth opens beyond a certain threshold, it acts as a trigger to activate or deactivate the mouse control system.

4.Mouse Activation: Once the MAR exceeds the set threshold, the system switches to mouse control mode. This mode enables the system to interpret further facial gestures as mouse commands.

5.Nose Movement:The position of the nose is continuously tracked across frames. Movements of the nose guide the cursor on the screenleft, right, up, or downallowing real-time navigation.

6.Eye Wink: The system monitors eye aspect ratios to detect winks and blinks. A single eye wink is used to simulate a left-click, while both eyes closed may trigger scroll or other special functions.

7.Cursor Movement:Based on the detected nose movement, the cursor is moved smoothly on the screen. This allows users to point or hover over screen elements without using hands.

8.Click Event: An eye wink is interpreted as a click event. The PyAutoGUI library lets you automate mouse clicks, making it easy to interact with your system just like a real user would.

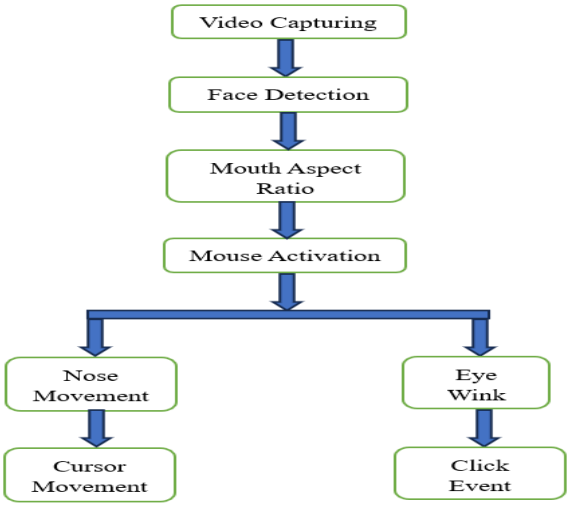
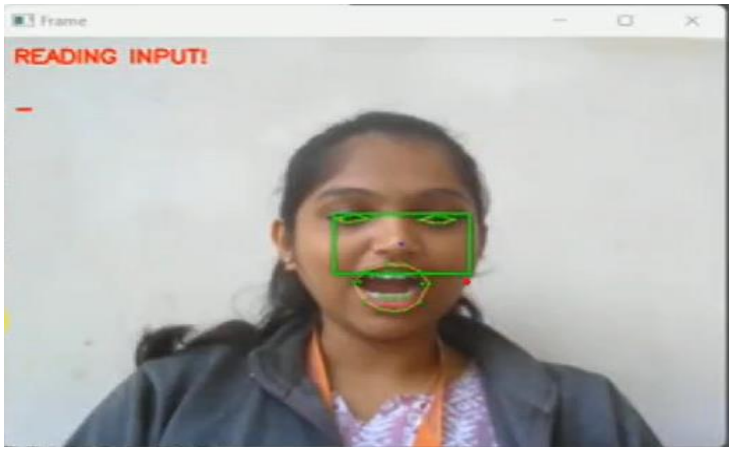


Figure1 :Methodology of Object Detection with Voice Alerts

IV. SNAPSHOTS

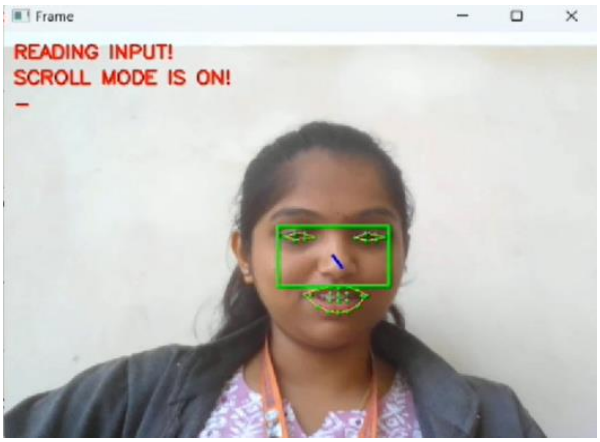


Snapshot1:Open mouth to start reading input

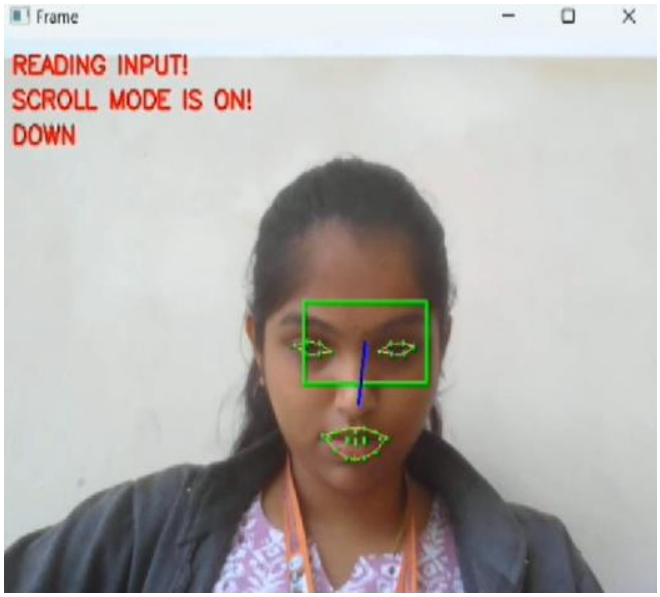
Snapshot2:Cursor Navigation towards left

Snapshot3: Cursor Navigation towards right

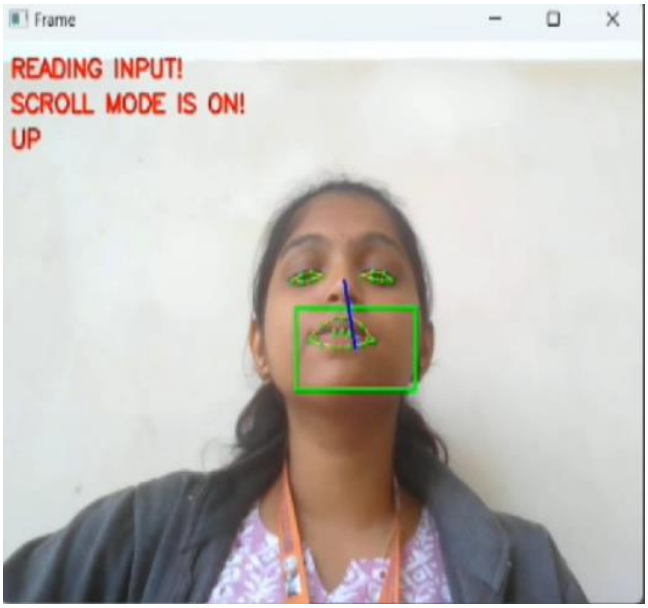
Snapshot4:UpwardNavigation



Snapshot5:Scroll Activation



Snapshot6: ScrollingDownward



Snapshot7: Scrolling Upwar

V. CONCLUSION

This project introduces an innovative, hands-free method of interacting with a computer using facial movements, removing the need for traditional input devices like a mouse or keyboard. By detecting key facial landmarks, the system allows users to control the mouse with simple gestures—like moving the cursor with nose motions, using mouth movements to trigger commands, and blinking to perform clicks. Technologies like OpenCV and dlib enable real-time facial tracking, while PyAutoGUI handles the mouse simulation smoothly.

An added feature, "scroll mode," is activated when the user closes both eyes for a few seconds. Once enabled, scrolling through documents becomes as easy as tilting the head up or down—making it especially helpful for reading or browsing without using hands.The system is responsive, precise, and user-friendly, offering a seamless experience. It's particularly valuable for individuals with physical disabilities, such as amputees, and in environments where hands-free control is essential—like sterile medical settings.

Overall, this project showcases how facial gesture-based control can improve digital accessibility and open new doors in the field of assistive technology.

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