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WEB-CAM EYE TRACKER FOR CONTROLLING MOUSE EVENTS

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Abstract - This paper introduces a web cam eye tracker to provide a hands-free interaction between humans and computers, allowing disabled people to perform mouse functions using their face and eye movement.HCI system uses eye movements to interpret computer mouse movements. The HOG (Histogram of Oriented Gradients) can be used to construct the face detector.. It uses a standard webcam,OpenCV, NumPy, and other packages for face recognition.The Face detector can be build using HOG(Histogram of oriented objects) .It is a hand free and doesnt require any external hardware. Web cam eye tracker allows amputees to control mouse events by monitoring users eyes.It is a hand free and doesn't require any external hardware or sensors

Index Terms – Human Computer Interaction (HCI), eye tracker, Histogram of Oriented Gradients(HOG) , Accuracy.

I. INTRODUCTION

There have been many research studies on human computer interface (HCI) to improve the interaction between the user and the computer system. Most of these are suitable only to normal individuals. Despite the success of these techniques, they were not suitable for the physically disabled individuals. The utilization of a mouse or a finger to navigate the cursor on a computer or mobile screen has become a widely adopted method in modern technology.. When The system notices any movement in the mouse or the finger to map it to the movement of the cursor. Some people, who do not have their arms to be operational, called as 'amputees' will not be able to make use of the current technology to use the mouse. Hence, if the movement of their eyeball & facial features can be tracked and if the direction towards which the eye is looking at can be determined, the movement It is possible to map certain facial features to the cursor, which would enable an amputee to manipulate the cursor according to their intentions.An 'eye-tracking mouse' will be of a lot of use to an amputee. When implementing, the following factors need to be considered

- Capacity to control the mouse cursor with eye movements
- , Adaptability to varied users
- Low cost
- Practical communication method
- Ease of use

II. LITERATURE SURVEY:

[1] The paper "Cursor control using eye ball movement" by Vandana Khare and Gopala Krishna proposes a method for controlling a computer cursor using eye movement. The paper presents a hardware setup consisting of a webcam and an infrared light source to track the movement of the eyes. The captured images are processed using computer vision techniques to detect the pupil and estimate its position in real-time. The authors then propose a novel algorithm for mapping the detected eye movements to cursor movement on the screen. The algorithm uses a dynamic thresholding technique to remove noise and improve accuracy, and a smoothing function to reduce jitter caused by small eye movements. The proposed method is implemented and tested on a group of participants, demonstrating promising results in terms of accuracy and speed of cursor movement. The paper highlights the potential of eye movement-based interaction as an alternative input modality for people with physical disabilities or who have difficulty using traditional input devices, such as a mouse or touchpad. The proposed method could also be useful in other applications, such as virtual reality or gaming. In conclusion, "Cursor control using eye ball movement" presents a novel method for cursor control using eye movement and demonstrates its feasibility through experimental results. The proposed method shows promise as an alternative input modality, particularly for individuals with motor disabilities, and could pave the way for further research in this area.[2] The paper "Eye Movement Based Human Computer Interaction" by Ramsha Fatima and Atiya Usmani presents a review of eye movement-based human-computer interaction (HCI) techniques. The paper discusses the advantages and limitations of eye tracking as an input modality, and provides an overview of different eye tracking methods and their applications in HCI. The authors review various eye tracking devices, including video-based systems, electrooculography (EOG), and infrared-based systems, and compare their features, cost, and accuracy. They also examine different eye movement metrics, such as fixation, saccade, and smooth pursuit, and their applications in HCI. The paper discusses a number of eye tracking-based interaction techniques, including gaze-based selection, scrolling, and zooming, as well as eye gesture recognition and eye typing. The authors provide examples of eye tracking-based applications in various domains, including accessibility, gaming, and virtual .

III. METHODOLOGY

The complete system is a combination of three models which optimizes the whole procedure of web cam eye tracker for controlling mouse events. The models are (a) Gaze point mapping (b) Blink detection (c)Template Matching.

IV. DEVELOPMENT

The development of a web cam eye tracker for controlling mouse events requires a architecture combination of image processing, data analysis, and user interface design It requires careful calibration and validation to ensure accurate and reliable tracking of the user's gaze. By using these techniques, it is possible to develop a web cam eye tracker that can provide an intuitive and efficient way for users to interact with their computer...

V. EXISTING SYSTEM

The OpenEyes project is an open-source eye-tracking system that uses a webcam to track eye movements and control the mouse cursor. The system uses Python and OpenCV for image processing and gaze estimation, and it can be used on any computer with a webcam.
To use the system, the user first needs to calibrate it by following a set of instructions to look at different points on the screen. This allows the system to map the user's gaze to the correct location on the screen. The calibration process needs to be repeated each time the system is used to ensure accurate tracking.
Once calibrated, the system tracks the user's eye movements and translates them into mouse cursor actions. This allows the user to control the mouse cursor by moving their eyes or blinking.

VI. LIMITATIONS

- In the existing system, to get an accurate image of the iris an IR sensor should be used.
- And a gyroscope can be used for the orientation of the head but this method requires the appropriate hardware.
- Our project aims to incorporate not only eye gaze and movements, but also eye gestures and facial expressions for tracking the mouse.

VII. PROPOSED SYSTEM

A standard webcam would be used to capture video of the user's face and eyes.The proposed system is based on detecting the features of the face and mapping them to the cursor, the webcam needs to be accessed first, which means that the webcam will be opened. Once the webcam is opened, the program needs to extract every frame from the video. The proposed system is about creating a script that can control the mouse using eye and mouth movements. The project uses Python programming language, Anaconda IDE, and several libraries including OpenCV, Dlib, imutils, and PyAutoGUI. The script detects the face and facial features such as eyes and mouth using a pre-built Dlib model The next step is to identify blinking/winking and yawning using the The Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR) refer to the ratios used to measure the proportions of the eye and mouth regions, respectively., respectively. . These actions are then translated into mouse actions. The script also resizes the captured video, converts it to grayscale, and detects the facial landmarks using the pre-built Dlib model. The detected landmarks are then used to draw contours around the required facial regions such as eyes, nose, and mouth.The proposed system provides an alternative input method for individuals with physical disabilities or limitations that make it difficult or impossible to use traditional input devices like a mouse.

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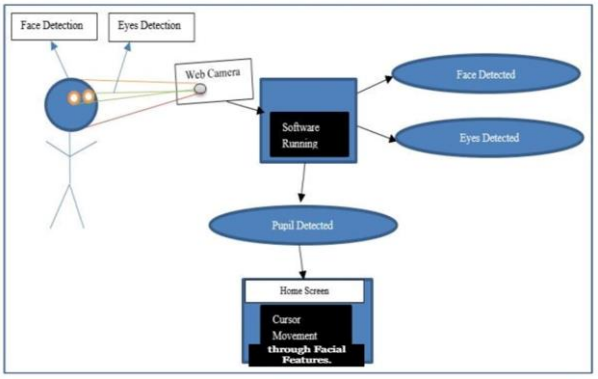
The system being proposed encompasses the following set of actions:

- Opening the Mouth
- Right Eye Wink
- Left Eye Wink
- Squinting Eyes
- Head Movements (Pitch and Yaw)

Advantages

- Hands-free mouse cursor control system.
- Facilitating the incapacitated.
- Mouse pointer control through eye movements and facial expressions.
- Simulating mouse functions, performing different mouse functions such as left click, right click, double click and so on using their eyes and facial features

VIII. ARCHITECTURE



Architecture

IX. MODULES:

- **Eye Tracker**: The eye tracker module consists of hardware and software components that detect and track the user's eye movements. The eye tracker can be based on different technologies, such as infrared, electrooculography (EOG), or video-based tracking.
- **Gaze Mapping**: The gaze mapping module takes the raw eye-tracking data from the eye tracker and converts it into a gaze point on the screen. This involves calibrating the eye tracker and using algorithms to translate eye movements into screen coordinates.
- **Pointer Control**: The pointer control module takes the gaze point information and translates it into a control signal that moves the on-screen pointer. The pointer control module can also include features such as click and scroll control.
- **User Interface**: The user interface module provides the visual feedback to the user, such as the gaze pointer and other on-screen elements. The user interface can also include customizable settings and options for the user to adjust the behavior of the gaze pointer

X. RESULT ANALYSIS AND CONCLUSION:

The proposed system successfully replicated a mouse's functions, including its eye and mouth motions. The outcomes were deemed satisfactory as the system was able to reproduce left and right click operations by detecting winks from the corresponding left or right eye. Similarly, the scroll function of the mouse was also successful. The system was able to move the cursor based on the direction of the user's gaze, albeit at a slow speed, indicating the need for further improvements. Eye and mouth tracking-based mouse control system has the potential to revolutionize human-computer interaction and make it more accessible and user-friendly for people with different abilities. This system can be particularly beneficial for people with physical disabilities that make it challenging to use traditional input devices, such as a mouse or keyboard. Eye and mouth tracking-based mouse control systems can enable these individuals to interact with computers and other digital devices more efficiently and independently. However, this system also presents some significant challenges, including detecting and tracking the eye and mouth regions accurately and reliably in different lighting conditions and head positions. This project requires a robust and accurate computer vision algorithm that can detect and track the eye and mouth regions under varying conditions. Furthermore, mapping the eye and mouth movements to specific mouse movements and clicks can be a challenging task that requires careful calibration and testing. Overall, the eye and mouth tracking-based mouse control system can significantly enhance the quality of life for people with disabilities and make human-computer interaction more inclusive and accessible. However, the successful implementation of this system requires careful consideration of the technical, practical, and ethical implications of the project.

XI. FUTURE SCOPE

There are several future enhancements that could be considered for the proposed system Gaze Pointer. Some of these enhancements include:

- Machine learning-based tracking: Instead of relying on traditional computer vision algorithms, the system could use machine learning techniques, such as deep learning, to improve tracking accuracy and adapt to different users and environments..
- Natural language processing: The system could be enhanced to recognize voice commands and integrate natural language processing to enable users to interact with the computer using speech.
- Mobile application: The system could be adapted to run on mobile devices, such as smartphones or tablets, to provide a more portable and flexible alternative to traditional input devices.

These enhancements can improve the functionality, usability, and accessibility of the eye and mouth tracking-based mouse control system, and enable a wider range of users to benefit from this technology.

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