ENHANCING ACCESSIBILITY AND USER EXPERIENCE THROUGH HEAD CONTROLLED MOUSE

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Abstract— For someone with physical limitations, using the mouse is challenging. In order to find a solution for those who are physically unable to use the mouse, we have provided this mouse cursor control utilising head motions, which is an alternative technique of accessing a computer using head and eye movements to operate the mouse. Using Head movements and iris movement the input is given to the computer as Human Computer Interaction. In order to improve the dependability, portability, and usefulness of eye tracking technology in user-computer communication, a ground-breaking eye control approach is proposed in this system using Webcam and without the need for any additional hardware. This system focuses on providing a simple and useful interactive approach. The suggested system explains how to employ both iris and head movement, maps the head position, and uses a webcam to control the cursor and perform click operations on the screen. It is developed using Python.

Keywords— Mouse cursor control, webcam, Human-Computer communication, Eye tracking Technique.

1. INTRODUCTION

Our goal is to create a cost-effective application that is based on the user's feature classifications rather than biometrics and does not require them. Less hardware and easier algorithms should be used. The goal is to employ a system that will assist those with upper-limb disabilities who are unable to use a regular mouse.

A head-controlled mouse is a system that allows users to control the movement of a computer mouse cursor with head movements, rather than using their hands. This can be particularly useful for individuals who have limited mobility in their hands or arms, or for those who find it difficult or uncomfortable to use traditional input devices like a mouse or track pad.

The head-controlled mouse system typically uses a camera to monitor the movement of the user's head, and translate those movements into corresponding movements of the mouse cursor on the screen. The system can be calibrated to the user's specific head movements and preferences, allowing for more precise and accurate control of the mouse cursor.

There are a variety of head-controlled mouse systems available on the market today, ranging from simple software-based solutions that can be used with a standard webcam, to more complex hardware systems that use specialized sensors or motion-tracking devices. These systems can be particularly useful for individuals with disabilities or injuries that affect their ability to use traditional input devices, allowing them to more easily navigate and interact with computers and other digital devices.

2. LITERATURE REVIEW

Ranjeet Saroj, Avnish Kumar, Abhilash Moolya, Deepika Pandit (2018) conducted a study that proposed a journal for [**1]** which is an approach for Human computer Interaction (HCI), where they have tried to control the mouse cursor movement and click events of the mouse using hand gestures. Here, a

webcam was used to record real-time footage. In order to give the system information, the user wears coloured tapes. Furthermore, the system could respond incorrectly if there are other coloured items in the background. A journal on **[2]** was suggested by Sarita(2013). Additionally, the system could respond incorrectly if there are background objects with different colours. "Performing Computer Operations with Voice Controlled Mouse" was the topic of Sarita's (2013) proposal for a journal. Her work explains how using speech-based interaction might improve the usability of computers. Her research explains how speech-based interaction might improve the usability of computers. Her research describes how to make computers more usable by using speech-based interaction. She Proposed a system will use speech (voice system will move mouse pointer) and non-speech characteristics of human voice for hands free computing. The mouse pointer will be controlled by the system using human speech traits. Each individual module consists of different techniques and algorithm like feature LPC, Neural classifier. This consumes more time to perform operations because of use of only discrete interaction. Heydari Gorji and Ali (2018) published a paper named **[3]** where he made an investigation for controlling mouse movements based on Head tilt. They proposed a method that uses two pairs of IR LEDs and photodiodes to calculate how far the LEDs are from the user's chin's edges. Assistive technologies developed for enabling hands-free cursor control are mainly divided into eye trackers, head trackers, tongue trackers, brainwave (EEG) sensors and muscle tension sensors (EMG) camera-based systems require continuous image processing which requires nontrivial computation power and can operate for at most hours on a battery this makes them unsuitable for portable long-term usage in the range of weeks or months.

3. EXISTING METHODOLOGY

The former proposed systems used complex algorithms. They were grounded on the biometric identification techniques. Some demanded to mount bias on the stoner like Spotlights which wasn't doable.

EEG-based systems: These systems use electroencephalography (EEG) technology to detect brain activity and translate it into movements of the mouse cursor. EEG-based systems require the use of specialized EEG headsets and can be more complex to set up and use than other types of head-controlled mouse systems. EEG-based systems can be highly accurate and can provide precise control over the movement of the mouse cursor. However, they can be more complex and difficult to set up and use than other types of head-controlled mouse systems, and may require extensive training or calibration to achieve optimal performance.

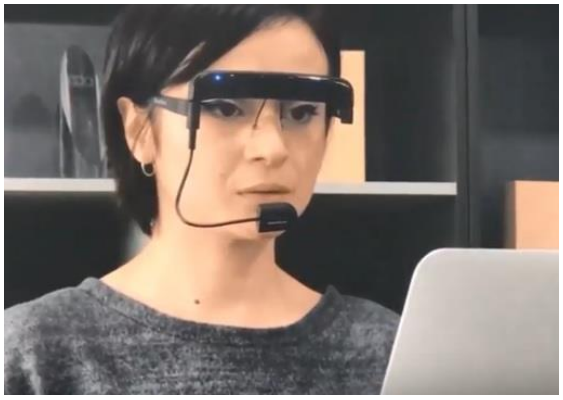

Fig 3.1 Input from mounting devices to Computer

4. PROPOSED METHODOLOGY

The proposed system describes the implementation of both iris and movement of cursor according to head position which can be used to control the cursor on the screen using webcam and implemented using Python. We are proposing five motions as the basis of head movements, namely, standard head, head left, head right, head up, and head down, the face which represents the detected head (the head in this project refers to front area of the face).This project is deeply centered around predicting the facial landmarks of a given face. We can accomplish a lot of things using these landmarks. From detecting eye-blinks **[4]** in a video to predicting emotions of the subject. The applications, outcomes and possibilities of facial landmarks are immense and intriguing.'s prebuilt model, which is essentially an implementation of , not only does a fast face-detection but also allows us to accurately predict 68 2D Dlib's facial landmarks **[5]** Very handy. Using these predicted landmarks of the face, we can build appropriate features that will further allow us to detect certain

actions, like using the eye-aspect-ratio **[6]** (more on this below) to detect a blink or a wink, using the mouth-aspect-ratio **[6]** to detect a yawn etc or maybe even a pout. In this project, these actions are programmed as triggers to control the mouse cursor. PyAutoGUI library was used to control the mouse cursor.

5. LIMITATIONS

- Training time: Head-controlled mouse require users to learn a new way of interacting with their computer. This can be challenging for some users, especially those who are not used to technology or have cognitive or learning disabilities. Training time and ongoing support may be necessary to ensure that users can effectively use the device.
- Limited range of motion: Head-controlled mice require the user to have a relatively stable head position to ensure accurate control of the cursor. If the user has limited range of motion or frequent involuntary movements, it can be difficult to maintain precise control of the cursor, which can negatively impact the user experience.
- Limited compatibility: Head-controlled mouse devices may not be compatible with all software and applications, which can limit their usefulness for some users. Additionally, some devices may require specific hardware or software configurations, which can make them more difficult to set up and use.
- Limited accuracy: The accuracy of the cursor movement is dependent on the quality of the facial landmark detection and tracking algorithm. While the project uses state-of-the-art algorithms, the accuracy may still be limited, particularly for users with more complex facial expressions or movements. This can impact the user experience and make the device less effective for some users.
- Limited hardware compatibility: The project relies on specific hardware, such as a webcam, to function correctly. While most modern computers have built-in webcams, the quality and positioning of the camera can impact the accuracy of the cursor movement. This can limit the accessibility of the solution for some users who do not have access to compatible hardware.

6. SYSTEM ARCHITECTURE

System architecture refers to the high-level design of a complex system. It involves identifying the various components of a system, specifying how they interact with each other, and defining the rules and protocols that govern their behavior. A system architecture typically consists of multiple layers, each of which serves a specific purpose

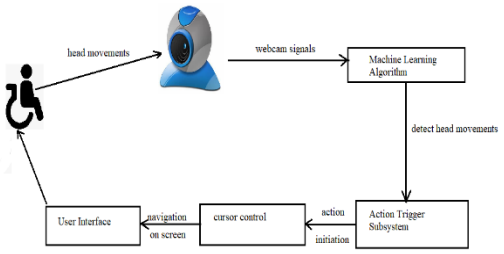

Fig:6.1 System Architecture

7. MODULES

- Main Interface:The main interface in a head-controlled mouse is typically a software application that provides a graphical user interface (GUI) for controlling the mouse cursor using head movements. This interface allows the user to adjust various settings and preferences, such as cursor speed, cursor control mode, and click settings.
- A mouse simulation engine: It is a software component that emulates the functionality of a physical mouse on a computer system. It allows users to control their computer using alternative input methods such as head movements, eye tracking.
- A Halt module: It is a feature that enables the user to temporarily disable the head tracking system or the clicking system. This can be useful in situations where the user needs to take a break or reposition themselves, without inadvertently triggering unwanted cursor movements or clicks. The halt module typically consists of a switch or a gesture that the user can activate to pause the mouse cursor movement and/or the clicking function. When the halt module is activated, the

head tracking system stops detecting head movements and the clicking system stops registering clicks until the user deactivates the halt mode.

- The mouse function :It is a component that allows the user to perform various mouse-related functions using head movements, such as left-click, right-click, double-click, and scroll.
- The user action detection :It is a component that detects and interprets the user's head movements and gestures to perform specific actions or tasks, such as moving the cursor, clicking, or scrolling.

8.RESULTS AND CONCLUSION

Head-controlled mouse technology has enabled individuals with limited mobility in their hands and arms to use computers effectively. It is a revolutionary assistive technology that has greatly improved the quality of life for people with disabilities, allowing them to communicate and interact with the world around them. The technology works by using a camera or sensor to track head movements, which are then translated into mouse movements on the computer screen. This allows users to control the mouse cursor, click on icons, and even type using an on-screen keyboard, all without the use of their hands.

Overall, head-controlled mouse technology has proven to be a game-changer for people with disabilities, providing them with greater independence and access to technology. With ongoing advancements in this technology, we can expect to see even more innovative solutions in the future, further improving the lives of individuals with disabilities.

Fig:8.1. Opening Mouth Activate/Deactivate Mouse Control

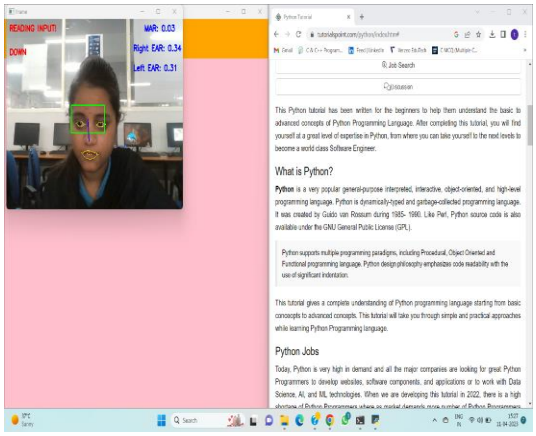

Fig:8.2 Cursor Movement towards Down

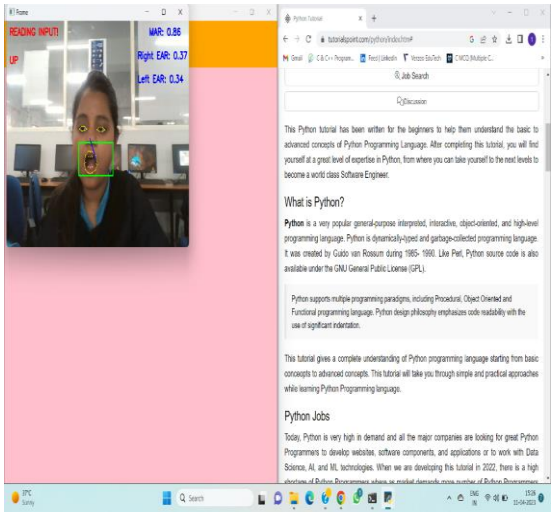

Fig:8.3 Cursor Movements towards UP

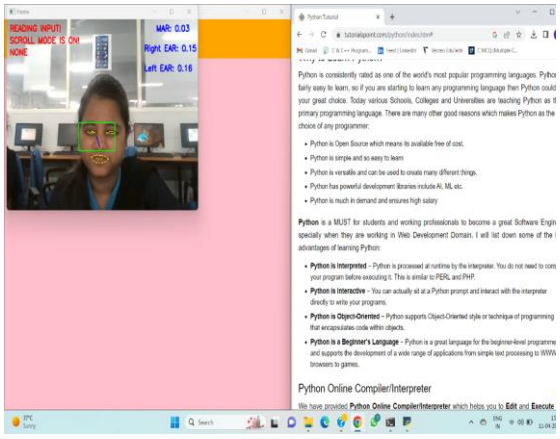

Fig:8.4 Squinting eyes Activate/Deactivate Scrolling

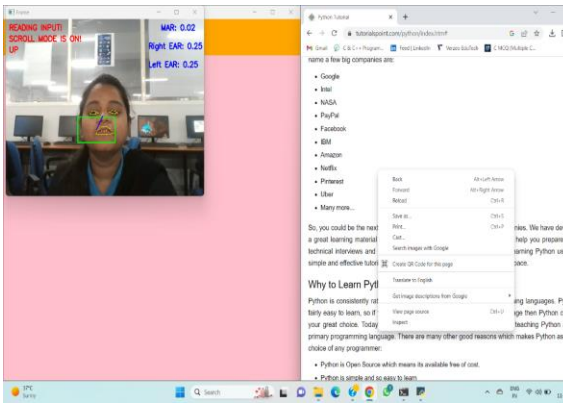

Fig:8.5 Scrolling Up

9. FUTURE SCOPE

The future scope for head-controlled mouse technology is vast and exciting. As the technology continues to advance, we can expect to see even more innovative solutions that enhance the user experience and provide greater accessibility to individuals with disabilities. Here are some potential future developments in head-controlled mouse technology:

1. Improved accuracy: With advancements in computer vision technology, we can expect head-controlled mouse systems to become more accurate and reliable. This will make it easier for users to navigate their computers with greater precision.

2. Integration with voice recognition technology: In the future, head-controlled mouse systems may be able to integrate with voice recognition technology, allowing users to control their computers using voice commands in addition to head movements.
3. Increased portability: As the technology becomes more compact and lightweight, we can expect head-controlled mouse systems to become more portable, allowing users to easily take them on the go.

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