Eyeconnect- A Visionary Keyboard

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Abstract

In our digital world, good communication tools are vital. Regular keyboards are not enough to understand our eye movements, which limits communication. The EyeConnect Visionary Keyboard fixes this using smart technology that tracks and relates our eye movements. This research gives a brief light on eye-tracking keyboards which will help disabled people to control devices using eye movements. This novel idea explores virtual keyboard working benefits and challenges. This research gives an insight on how eye-tracking keyboards make digital communication easier and more inclusive.

Keyword: AI Algorithm, Virtual keyboard, computer vision, Human computer interaction (HCI), Eye gaze technology, Eye movement detection, Machine Learning.

1. Introduction

The eye contactable keyboard represents a significant advancement in human-computer interaction, employing cutting-edge computer vision and machine learning algorithms to track users' eye movements and interpret their intentions. By seamlessly integrating voice commands and touch inputs, this innovative interface ensures innovation and adaptability for a diverse range of users.

Human-computer interaction (HCI) emphasizes the interplay between individuals and computer systems, with the interface playing a central role. Eye gaze technology emerges as a critical aspect, particularly beneficial for individuals with physical disabilities. Eye movements and blinking serves as primary methods of interaction, holding promise in various domains such as security, typing, and information tracking.

The primary objective of the eye contactable keyboard is to create a communication interface where users can effortlessly type or interact with devices by establishing eye contact with specific elements or keys. Tailored primarily for individuals with disabilities or limited motor function, its purpose is to enhance accessibility and communication, empowering users to express themselves and control devices effectively through eye movements and gaze tracking.

People with disabilities may face various challenges by using computer systems, inaccessible user interfaces, difficulty while using input devices like keyboard or mouse, lack of compatibility with assistive technologies and inaccessible websites or software. These barriers can limit their ability to access information, communication and participate fully in digital activities.

The scope of the eye contactable keyboard extends across multiple domains, including augmented reality/virtual reality (AR/VR), healthcare, gaming, and accessibility. Its applicability varies depending on specific use cases and the need to maintain eye contact while typing or interacting. Whether in video conferencing, accessibility tools, educational settings, or gaming interfaces, the eye gaze virtual keyboard finds diverse applications, demonstrating its versatility and potential impact across different fields.

Eye-contactable virtual keyboards offer significant benefits for disabled individuals, enabling increased independence, customized interfaces, and efficient communication. They empower users with severe physical disabilities to operate computer and mobile devices independently, facilitating communication, access information and participation in digital activities.

2. Literature Review

The problem this system addresses is enabling text input for physically disabled individuals solely through eye movement, aiming to minimize typing effort and provide a robust solution for those who cannot use their fingers for typing. The proposed system in this paper provides a new dimension in the life of those people who haven't any other physical abilities without eyes movement. This system will help afflicted people to type their text without touching the keyboard. The main aim of this project is to minimize the effort for typing and to enable typing of those people who are crippled and are disabled to type by using their fingers. And surely this system will come out as a robust technique and blessings for the users. [3]

The problem is to provide people with disabilities a hands-free interaction with computers, primarily using facial expressions like eye and mouth movements, for precise control of the virtual mouse and keyboard. People with disabilities will find this useful when utilizing the physical components of a system to control the pointer points and virtual keyboard operations. Because one's eyes alone can move the mouse and perform virtual keyboard activities, without no outside assistance. The system works by facial expressions like movement of eye-ball and mouth movement. By applying a Haar classifier the system identifies the region of the face, eyes, and mouth that are detected and extracted for processing. It controls the action of the virtual mouse and virtual keyboard by providing a hands-free interaction between humans and computers. To achieve efficient and precise movement, this technology may be expanded to include eye movement and blinking.[1]

Developing a hands-free cursor control system for people with physical disabilities to reduce reliance on a mouse, improving computer accessibility in poor lighting. The primary objective of this project is to create a hand-free cursor control system that reduces the reliance on a mouse. Our focus is on individuals with physical disabilities who are unable to use their hands to operate a computer system, especially in poor lighting conditions. The proposed model serves as a viable solution for both physically disabled individuals and those without disabilities, enabling them to use the computer effortlessly. Furthermore, the project has the potential to evolve into an operating system that utilizes multiple threads to efficiently run various applications simultaneously. This system will significantly benefit people with physical challenges by providing access to mouse functions and actions.[6]

The problem addressed is how to enhance the performance and interactivity of video games by integrating eye-tracking technology into the game play, thereby improving player immersion and overall gaming experience. This paper has focused on introducing new input for video games. Eye movement is one of the important inputs in video games. It increases the interaction between the players and makes it more interesting and challenging. The case study has been conducted on 48 players (undergraduate BSc students) to test the game with different input mouse, keyboard, mouse keyboard, and eye movement. The outputs have shown the significant effect on playing the game regarding scoring the point using eye input techniques and this adds privilege to using more input and makes the game more interactive. However, the game will slow down but this depends on the game scenario. Finally, the results show significant correlation between all inputs eye, mouse, and keyboard.[8]

The problem addressed is to provide paralyzed individuals with a means to control a wheelchair and type on a virtual keyboard using eye-gaze technology, thereby enhancing their independence and communication capabilities. This study presented an eye-controlled wheelchair system with a virtual keyboard. The system allows handicapped and physically challenged people to operate their wheelchairs in the direction they desire. The system's functionality is totally dependent on the movement of paralyzed patients' eyes. This system works perfectly in normal day-light environments, but it will be challenging to work perfectly in low-light areas.[2]

The problem addressed is the need for assistive communication devices specific to languages like Hindi, as demonstrated in this paper, offering a novel virtual keyboard to aid individuals with mobility and speech impairments, aiming to improve their communication and quality of life. In this paper, a new multi-modal non-invasive virtual key-board using eye-tracking has been specifically created for the Hindi language. This Hindi virtual keyboard is based on tree selection method that includes audio and visual feedback for users with inclusion of 63 letters and extra delete command to correct the errors. [4]

Gaze input applications have grown, particularly in mobile environments, yet the Midas Touch problem persists, with dwell time remaining the dominant command activation mechanism. This paper proposes a method to dynamically adjust dwell time based on user comfort. Further research avenues include minimizing

visual search time, optimizing mouse speed control, implementing spell and grammar checkers, and exploring ways to eliminate dwell time entirely. These enhancements aim to improve text entry rates and accuracy in gaze-based text typing interfaces. [5]

This paper introduces a method to reduce dwell time and enhance visual search efficiency for key selection. User evaluation, focusing on text entry rate and subjective feedback, validates the proposed EyeK gaze-based text entry system as a viable alternative to existing mechanisms. Further research avenues include improving mouse speed control and implementing spell and grammar checkers to enhance text entry accuracy. [7]

3. Limitation in using a keyboard for disabled users?

 • Trifling and closely spaced keys can be challenging to accurately press, especially for users with limited hand or finger movement or tremors.

 • The amount of force required to press keys may pose challenges for individuals with weakness in their hands or arms.

• Small key size and lack of contrast make it hard for visually impaired users to analyze the keys, affecting typing accuracy.

• The QWERTY layout can be confusing for individuals with learning disabilities. Overall, the current keyboard can be tricking for disabled individuals due to these factors.

4. Eye-Gaze virtual keyboard using Artificial Intelligence

Till now research has enabled text input solely through eye movement, enhancing accessibility and efficiency for physically disabled individuals. Utilizing facial expressions like eye and mouth movements for precise control of virtual keyboard and mouse, aiding individuals with disabilities. Tremendous use of mouse has been reduced for individuals with physical disabilities, improving computer accessibility, even in poor lighting. Integrating eye-tracking technology into video games for enhanced immersion and interactivity. Even empowers paralyzed individuals to control wheelchairs and virtual keyboards with eye movements, enhancing users' independence. Introducing multilingual virtual keyboard based on eye-tracking for individuals with mobility and speech impairments. Adapting dwell time based on user comfort to improve text entry rates in gaze-based typing interfaces. And even reduces dwell time and improving visual search efficiency, offering an alternative text entry system with potential enhancements in mouse speed control and spell checkers.

5. EyeConnect - A Visionary Keyboard

EyeConnect visionary keyboard is an innovative input device revolutionizing human computer interaction. It employs advanced AI algorithms to track and interpret users eye movements, enabling natural and engaging communication. Designed for individuals with limited motor function, it enables typing and device control solely through eye gaze, enhancing accessibility. By bridging the gap between users and technology, it provides a new dimension of interaction for those with disabilities. EyeConnect represents a robust solution, for individuals with limited physical abilities. It aims to enhance the lives of its users in the digital age.
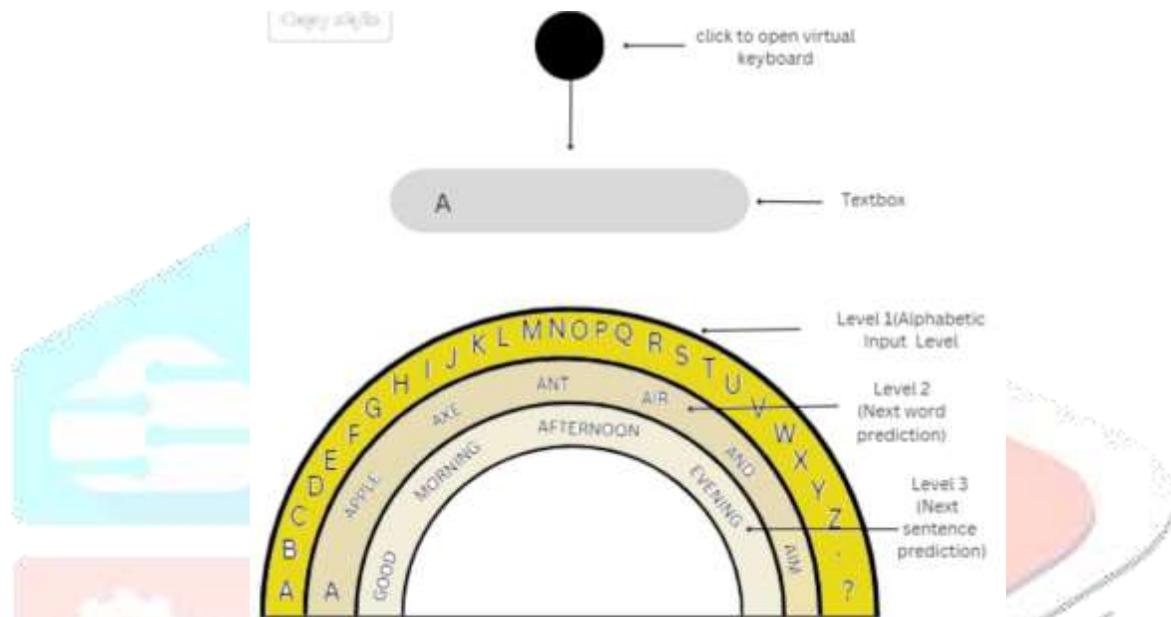

Figure 1: EyeConnect Keyboard Model

EyeConnect Visionary Keyboard comprises of three level:

• **Level 1: Alphabetic Input level** -The input level in EyeConnect serves as the initial stage where user interactions, including keystrokes on alphabet keys, are received and processed. This acts as the interface between the user and the predictive text system, collecting input data for further analysis and prediction. This layer captures user actions, such as eye movements, and converts them into a format that can be understood and processed by subsequent layers. Here system utilizes a facial detection model, such as those offered by MediaPipe OpenCV, to identify the users face within the video stream. Then employed libraries like PyAutoGUI to input the recognized characters into the system.

• **Level 2: Next word prediction level** -The next word prediction level in EyeConnect leverages LSTM (Long Short-Term Memory) algorithms to analyze input and context, generating accurate predictions. LSTM's ability to retain information over extended sequences enhances the predictive accuracy of EyeConnect's next word suggestions. LSTMs are preferred for word prediction because they excel at grasping

the extended relationships within sequential data and maintaining context by utilizing memory cells and forget gates.

• **Level 3: Next sentence prediction level** -In EyeConnect, next sentence will be predicted utilizing LSTM algorithms to analyze the current context and predict the next sentence. LSTM networks excel at capturing dependencies in sequential data, enabling EyeConnect to anticipate the user's intended sentence accurately.

6. Conclusion

The emergence of the EyeConnect visionary keyboard represents a significant advancement in human-computer interaction, particularly for individuals with disabilities. Standard keyboards fail to capture and understand users eye movements, limiting communication possibilities. However, through innovative technology and advanced AI algorithms. EyeConnect keyboard overcomes this barrier by accurately tracking and interpreting users eye movements. This research sheds light on the potential of eye-tracking keyboard to empower disabled individuals by enabling them to control devices using only their eyes.In essence, LSTMs excel in word prediction by effectively understanding the prolonged connections in sequential data and ensuring contextual significance through their advanced memory cell and forget gate mechanisms. In a nutshell, EyeConnect represents a trans-formative tool that has the potential to significantly improve the lives of individuals with disabilities in our digital era.

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