Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 7.056

IJCSMC, Vol. 12, Issue. 11, November 2023, pg.22 – 28

EOG Based Eye Blink Detection using VB GUI for Eye Writing Applications

M. A. Vijay Kamalnath[1]; D. Yovan Snanagan Ponselvan[2]; S. Asif Basha[3]; U. Meri Kishore[4]

[1]Assistant Professor, ECE, RGMCET, Nandyal, India
[2]Assistant Professor, ECE, RGMCET, Nandyal, India
[3]Assistant Professor, ECE, RGMCET, Nandyal, India
[4]Assistant Professor, ECE, SRIT, Proddatur, India
kamalmav@gmail.com; dyspece@gmail.com; asifbasha406@gmail.com; kishoreecepg@gmail.com

DOI: https://doi.org/10.47760/ijcsmc.2023.v12i11.002

Abstract*: *Usage of bio-signals from Electro-Oculo-Gram (EOG) in Human Computer Interaction (HCI) systems is one of the burgeoning study areas as of now. In order to provide support for physically challenged persons (or keypad Contactless HCI) in operating basic computer functions without making any physical touch with the computer keypad or mouse, we propose a framework utilization concept that changes movement of cursor on the computer screen using virtual keypad based on Visual Basic Graphical User Interface (VB GUI) with the eye movement detection through webcam of the system for different computer functions. In this work, VB GUI platform is used for a web browsing application and corresponding platform operation steps have been included. With the VB GUI, the basic cursor movements in the directions of left, right, up, and down to access the web links on the web page which is treated as eye writing in the concept of human computer interaction. Similarly, we can access different computer Apps such as MS-Doc, XL sheets, Audio and video files etc. Further, this paper focus is on prototype development of different home automation system applications.

Keywords*: *Human Computer Interface (HCI); Electro-oculo-gram (EOG); Cursor Movement; VB GUI; Home Automation System.

I. INTRODUCTION

Now-a-days, the utilization of computer is unavoidable. Still, for physically disabled people this is a difficult issue, and they've to look for other's help to perform computer grounded operations. Importantly when it comes to situations similar as operating the computer or laptop for web grounded operations or simple document opening or ending, or playing a music train or videotape train.

In some extreme cases, they may not be congruous to move any branches except the ocular perceivers and face muscles. As technology of mortal computer interface is peaking in the recent times grounded on the memoir signals, hence to make the lives more facile for kindred paralyzed people, utilization of bio-potential signals homogeneous as EOG is needed in kindred field of operation.

One of the new input approaches for similar situations is taken into consideration and, eye- movements are detected using optic or infrared cameras, and the ideal of a stoner is linked. Bioelectric signals, similar as electroencephalograms (EEGs), electromyograms (EMGs), and electrooculograms (EOGs) were also employed to understand a stoner's intention. An EOG operates from the standing eventuality between the front and reverse of the eyes, and therefore, it represents eye- movements. The use of EOGs was one of the first styles to measure eye- movements, and it has been anticipated to be a promising source for dispatches between mortal and computers.

Electro-oculogram (EOG) is a recorded signal, which is engendered by the implicit distinction between retina and cornea of the ocular perceiver due to the metabolic rate of the retina being advanced than cornea leading to an advanced eventuality of cornea than retina. The positive pole is taken into consideration to be the corneal part and the retinal component to be a negative pole. These two poles are in charge of transforming a tiny electrical field quantum. Among all bio-signals, EOG is the most reliable, non-invasive, and economical. It is a common method for measuring eye movement, namely the perpendicular and vertical eye motions.

The electro-oculogram (EOG) is a record of the voltage changes obtained as the individual moves their eyes from one obsession point to another within the visual field while keeping their head still.

The goal of this study is to implement eye recognition and blink detection system in which the EOG signal is initially captured using a webcam system to get both the vertical and perpendicular eye movements for the movement of the cursor on the computer monitor.

II. LITERATURE REVIEW

[1] The IoT infrastructure described in this work is based on electro-oculography (EOG) and is designed to support, manage, and provide real-time coverage for smart homes for people with motor disabilities.

A graphic interface (GUI) with predetermined settings, such as controls for doors, windows, lighting, air pressure, temperature, and television features, allows the stoner to operate the intelligent landscape. Three saccadic eye movements must be combined in order to traverse the GUI (for example, move your eyes to the left while also moving your eyes to the right and left).

The created platform allows for the integration of voice recognition to create new commands, remote videotape monitoring, and the identification of the case's emotions. The platform would be more stable for future operations in this way.

[2] The corneo-retinal standing event, which may be utilised to mask fatal eye gyration, is the source of the electro-oculogram signal, which is an input for systems similar to this one. It is a crucial input modality for HCI systems due to its improved breadth, higher signal-to-noise ratio, and considerably simpler recording settings than EEG. The subject's eye movement towards the four middle screen edge corridors of a laptop positioned in front of them allowed for the acquisition of EOG signals. With a few modest adjustments, this system may be utilised for additional tasks (such wheelchair control). A multifunctional system might be created by using it as a cold-blooded component of other systems that employ the remaining range of mortal eye movement because it only uses a small percentage of the eye movement range.

[3] This work suggests a novel non-manual electro-oculogram (EOG)-based human-computer interface (HCI) that enables real-time interactions with a Virtual Reality (VR) environment. The EOG-based HCI in VR has a graphical user interface (GUI) with a number of randomly flashing buttons. The algorithm recognizes the eye blinks from the EOG signal and calculates the user's target button, while the user must blink in time with the associated button's flashes to send a command. Furthermore, patients with limb paralysis can use the music-on-demand system for amusement in addition to healthy individuals.

[4] A home automation system employing an Arduino UNO has been created in this work so that it can function by the cursor's movement and click when positioned in a specific location relative to the switches. By employing a WEBCAM system to route and capture the EOG signal, eye movement has been identified. This system's interface was designed using the VB (BASICS) GUI Software platform. By creating a circuitry similar to the WEBCAM system for the signal accession, making it transportable and affordable, and this system design may be made more compact.

[5] In the current work, it is suggested that electroencephalogram (EEG), electro-oculogram (EOG), and electrocardiogram (ECG) signals be obtained using gold-plated bobby electrodes with active correction. The level of signal quality obtained has been contrasted with that of signals obtained with conventional detectors. It is possible to observe that the best de-noising has been accomplished.

[6] In this study, a two-channel electro-oculography (EOG)-based HCI model is suggested to improve the contact ability and quality of life for paralysed people who are unable to talk or move an extremity, employing 20 participants and an ADT26 Bio amplifier. Gold-plated electrodes were used to record EOG signals from 11 activities that involved both horizontal and vertical eye movement. Utilising VB(BASICS)GUI, a graphical user interface was created to aid in user communication. Conduct real-time research with patients in the future, and increase training to enhance classification accuracy.

[7] In order to control assistive robots, this research introduces a novel mortal computer interface based on the EOG signal. The generating medium for EOG, the collecting system, and the experimental plan are initially introduced in this work. Additionally, it examines the origin of the autoregressive spectral entropy point. To identify the EOG signal with three-dimensional point vectors, Coming utilises the support vector machine founded on multi-classifier model.

[8], [11] For the first time, grapheme-coated electro-conductive textile electrodes were used and characterised for EOG acquisition to overcome the constraints of traditional electrodes. The development of wearable human-computer interfaces as well as the seamless integration of grapheme textiles with standard clothing and electronics and battery-powered operation may revolutionise EOG applications such as the monitoring of epileptic patients and driver drowsiness, diagnostic polysomnogram tests for sleep disorders, and driver monitoring.

[9], [13] The concept and implementation of an Electro-oculogram (EOG)-based human computer interface are presented in these works. The main results of this research are mouse cursor movement and eye gesture-based Hardware control for wheelchairs, robots, and other devices.

[10], [14] According to this study, the device's ease of use, portability, and convenience of wearing make it superior to current EOG recorders. The recording software is an Android app, making it ideal for both everyday users and Internet of Things (IoT) applications that rely on eye tracking. Additionally, a cloud-based system will be implemented, allowing many users to submit their EOG data, which can then be analyzed online and utilised to monitor a variety of patients and drivers.

III. METHODOLOGY

The video-based assessment of eye positions has been most extensively employed to construct an eye movement-based HCI system. The reflected light from the eyes is used in video-based eye tracking techniques, and it may be captured by a camera or an optical sensor with both vertical and horizontal motions. When compared to previous eye tracking techniques, these approaches offer extremely sensitive and precise predictions of gaze directions.HCI activity tracking devices with a pair of ear-mounted EOGs.

This prototype made use of the eye tracking technique based on EOG. The start and finish periods of eye movements, eye blinks, and course-directional changes in gaze are only a few characteristics that are used by HCI systems based on EOG-based eye-tracking. The ability of these systems to provide a variety of input patterns to general HCI systems is constrained, despite the fact that they may be beneficial in particular situations.

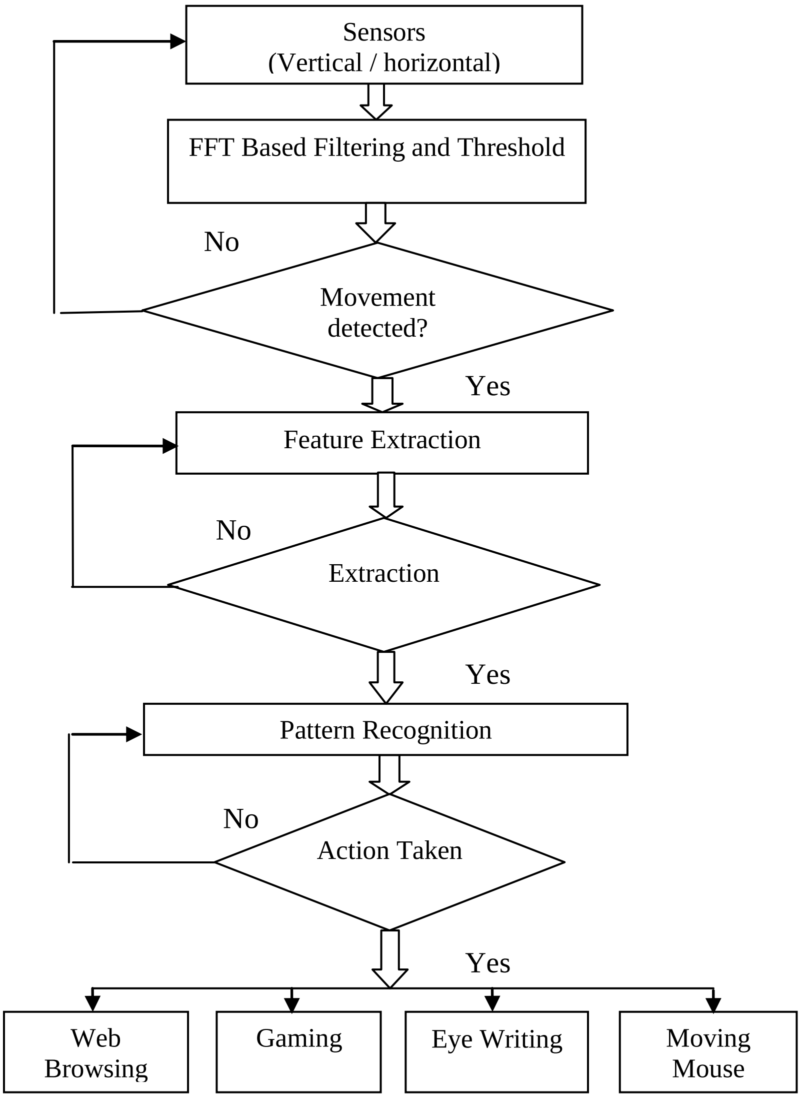

Fig.3.1: Flow chart of the Eye Blink Detection System.

IV. RESULTS & DISCUSSION

In this Results section, proposed system design results have been executed and included with the B-Link VB-GUI. B-Link is able to detect intentional winks and interpret them as instructions for particular operations on the computer. The application has its own graphical user interface (GUI), presented on the screen (Fig.5.1). The purpose of the GUI is to sequentially mark the keys.

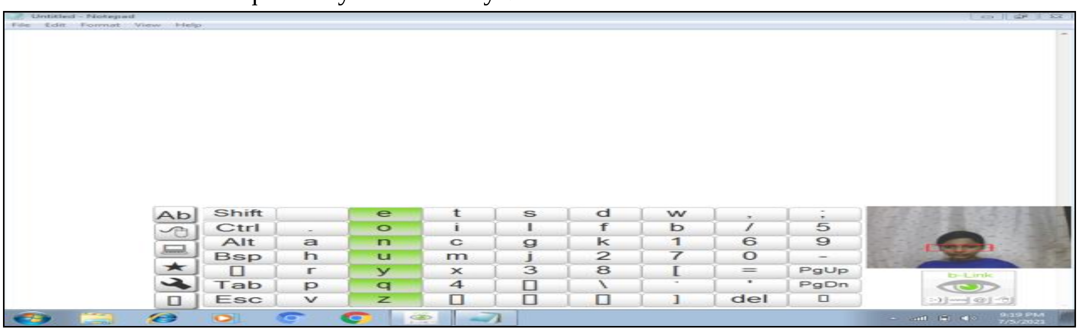

Fig.5.1: Eye Blink GUI Front Page view

Fig.5.2: Keyboard layout when the shift key is applied.

The keyboard also allows you to use key combinations (Fig. 5.2), mainly it is possible to use the Shift key to enter the capital letters and the symbols of the spare keys. After choosing the Shift key or / and the Alt key, the keyboard changes its layout, displaying another collection of keys.

Fig.5.3. The mouse screen shows chosen directional arrow.

Blinking when one of the mouse arrows is marked (in orange) moves the cursor in the chosen direction (In Fig 5.3). The user can stop this movement with a wink in a row. The keys L, R and 2L are the keys corresponding to the left mouse button, the right button, double-click of the left button. Shift and Ctrl keys are used for more advanced tasks, like marking text or marking multiple menu options is possible to operate in multi directions.

Fig.5.4: The mouse screen shows the marked left key

Fig: 5.5: The bookmarks screen

The role of this menu (Fig. 5.4 & Fig.5.5) is to store the links of the web pages most frequently visited by the user. User can add new bookmarks in locations (marked with plus sign). First we must blink while a location is marked, then select a web page address the right button - b-Link will capture the address to the clip board and add a bookmark and the"-" button to delete a bookmark. When a bookmark is chosen, the default internet browser is started to open the web page corresponding to the bookmark.

Fig.5.6: The preferences menu shows the marked speaker button.

Fig.5.7: The menu to shutdown the computer

The preferences menu allows you to adjust the parameters of b-Link and customize it in order to work with maximum ease and efficiency. Turn the sound on or off adjust mouse cursor speed adjust the period during which interface elements are marked.

Turning the sound on or off is done in a similar fashion. The button works as an on / off button (In Fig. 5.6 and Fig. 5.7) – each time it is "pressed" it causes the sound to turn on / off. The last icon in the main menu is associated with system shutdown. If you choose the Yes button, b-Link and all other applications will close and then the system will shut down.

V. CONCLUSION AND FUTURE SCOPE

In the present work, an EOG signal acquisition system has been designed and implemented. The work implements a method of operating the computer screen by cursor movement through the movement of eyes. This design system can function for the computer based works such as opening any computer application through eye movement.

Our work brings the modification in processing the recorded EOG signal and using it to operate a specific task through push buttons developed (by GUI) in the same platform of VB(BASICS)GUI Software. BLINK application has its own graphical user interface presented on the screen to make use of virtual keyboard for operating computer screen.

We can implement this project/paper for home automation purpose like switching on/off of light, fan, washing machine, fridge, etc.,. By this, we can use those appliance operation and control using our eyes. We can also implement this paper for blind people usage purpose prototype with voice recognition facility.

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