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SURVEY PAPER ON VARIOUS EYE BLINK DETECTION SYSTEMS

Anil C.B[1], Ammu Vijayan[2], Anjitha P.S[3], Ann Mary George[4], Baselios Paul[5]

Department of Computer Science and Engineering,Sree Narayana Gurukulam College Of Enginnering,Kadayiruppu,Ernakulam,Kerala,India

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Abstract— *This survey paper aims to provide a compre- hensive overview of the state-of-the-art in eye blink detec- tion systems, encompassing the methodologies, algo- rithms,datasets, and applications. By synthesizing the ex- isting literature, we seek to shed light on the challenges and advancements in this field, offering insights into the various approaches employed for accurate and efficient eye blink detection. The provided project have many chal- lenges be- cause the algorithms did not give correct re- sults. But time to time, several techniques are discovered for eye detection. In this survey paper, we describe and compare many techniques of eye blink detection through table. The purpose ofthis study is to provide a thorough resource for scholars, professionals, and hobbyists who are interested in learningabout the changing field landscape. Our aim is to stimulatefurther innovation in this field and develop a deeper under- standing of the importance of eye blink detection through acritical study of the material that has already been published.*

Keywords: Face Detection, Blink Detection, Eye Region Extraction ,Haar Cascade, Image processing Electroocu- lography (EOG)

I. INTRODUCTION

The human eye, with its intricate mechanism and dynamic movements, serves as a vital channel for nonverbal communication and interaction. The study of eye movements has gained significant attention in various fields, ranging from psychology and neuroscience to human-computer interaction (HCI) and biometrics. Among the myriad aspects of eye behav ior, the detection of eye blinks stands out as a crucial component due to its potential applications in diverse domains.

Eye blink detection systems have evolved over the years, propelled by advancements in computer vision, image processing, and machine learning techniques. These systems play a pivotal role in numerous applications, such as driver monitoring systems, fatigue detection, lie detection, hu- man-computer interaction, and even medical diagnostics.

II. RELATED WORKS

[1] The authors Madhumantimaiti et.al (2020) has proposed an Innovative Prototype to Prevent Accidents Using Eye Blink Sensors and Accelerometer ADXL330.This paper mainly tells about the innovative prototype that utilizes eye blink sensors and the accelerometer ADXL330 to prevent accidents represents a promising advancement in safety technology. By integrating these sensors, the system aims to enhance real-time monitoring and response mechanisms, particularly in situations where driver attentiveness is crucial. Monitoring eye blink patterns can provide insights into the driver's level of alertness, enabling the system to issue timely alerts or interventions when signs of drowsiness are detected. This could significantly reduce the risk of accidents caused by driver fatigue, a common factor in road safety incidents. The applications of the same is it can be used avaiation,healthcare,industrial safety etc .This Technology is realiable and real-world applicable.The drawback of this technology is false positives or negatives ,industrial variability,calibration changes etc.

[2] An Eye blink Detection system basically for Paralysed patients has been proposed by Milan Pandey et.al (2020) . The proposed system enables people with severe paralysis to communicate their thoughts and needs. It also helps patient to show their intellectual potential which can sometimes dispose their mental disability diagnosed by the doctor. The proposed patient provides a unique and

new UI which can be easily controlled by any age group patient. The proposed system combines existing techniques in a new way to detect eye motion and eye blink detection. The Eye Motion Algorithm is used to determine left, right or no motion. The Eye Blink Detection Algorithm is used to determine voluntary and Involuntary eye blinks can be used as a blink gestures in the proposed system. These two algorithm helps the patient to navigate efficiently in the proposed system and communicate. The proposed system, Consumer Grade PC/Laptop and Logitech webcam of $23.53 is used which decrease the cost and boost the use of the system in various environment like private or government hospital personal nursing, home, etc. The system setup and maintenance doesn't require any skilled labor and hence will reduce the cost of the system. The main drawback is system accuracy decrease in low lighting conditions and the webcam should always be in line of sight with eye of the patient.

[3] A Multimodel Human-Eye Blink Recognition Using Z-score Based Thresholding and weighted Features has been proposed by the author Puneet Singh Lamba et.al (2021).This paper mainly claims that eye blinks were detected using a blend of 5 weighted features (Vertical Head Positioning, Orientation Factor, Proportional Ratio, Area of Intersection, and Upper Eyelid Radius) depicting imperative gen (z score threshold), extracted from the circles uniquely formed from the eyelids landmarks. For testing the performance of the method, ZJU eyeblink dataset was used. While implementing the proposed method with the said dataset, it was observed that when there is an impulse in OF, it means that other features except UER will struggle to report a blink with a peak. In contrast, when OF has no impulse signals, it suggests the expected behavior, which peaks in all four features. The multimodal system's performance was increased to 97.2% (accuracy) with a precision of 97.4%. Other performance parameters also showed a decent routine. As a future scope, more features can be incorporated to increase the performance attributes further.

[4] The authors Taner Danisman et.al (2022) has propsed a paper called Drowsy Driver Detection System Using Eye Blink Patterns. The proposed system is independent from the head movements as it works within the same frame. Therefore, it has an advantage over the other systems that use statistical information from the past frames. In addition, it runs at a 110fps rate on Intel Xeon 2.9 GHz CPU for a 320×240 resolution which is acceptable for real-time scenarios and leaves time for other tasks. Unfortunately, no common database exists for comparing our results for drowsiness; therefore we only give the results for eye-blink detection. In addition, we planned to work on the Av@Car database for further comparison of our approach. The proposed system detects eye blinks with a 94% accuracy and a 1% false positive rate. The author's experiment showed that the proposed system produces fast and accurate results for the detection of drowsiness. According to the real world experiments, the most important factors that affect the performance of our method are the presence of glasses and high illumination changes. Indeed, the presences of glasses affect the core components of the system including face detection, eye detection and symmetry calculation.

[5] An Eye Blink Count and Eye Blink Duration Analysis for Deception Detection has been proposed by the authors Sabu George et.al (2021). In this paper, analysis of blink count and blink duration has been done by conducting a psychological experiment. In the experiment to detect deception, 50 subjects were asked a set of 10 control questions related to name, age, place, house, marital status, entertainment, food and religion and the eye blinks were recorded during the interview period using a high speed camera. The questions were repeated for truth and lie responses. The recording were started at the moment of asking the question, so that only the responses were recorded. The analysis shows that blink duration and blink count are more while lying.

[6] An Eye Blink detection using Monocular System has been introduce /proposed by the authors Koichi Takahashi et.al (2020). In this paper, they propose the on-line eye blink detection method, and they applied the proposed method to the real systems for the purpose of confirming the proposed method works well. Their method utilizes a simplified head model, and facial feature points can be tracked by particle filtering. Eyelid motions are detected as the deformation from the reference facial image. The proposed method requires only an inexpensive USB camera and required no intrusive physical markers. For the example of applications, EEG analysis for removing the eye blink signal works well, and we can obtain the EEG without eye blink noise. Because of the low computing cost, this eye blink detection method can work at over 60fps. Hence, it is possible to accurately synchronize the eye blinks and EEG. Additionally, the experimental results indicate the existing of the characteristic eye blink signals, and eye blink signal template can be obtained. Therefore the proposed method will contribute to real time artifact removal for simple electroencephalograph. Secondly, avatar system with eye blink detection is introduced. In the proposed system, we can easily puppeteer arbitrary "pmd" 3D model. In order to confirm the effectiveness of the proposed system, they confirm that the proposed system is able to accurately detect the eyelid motions. According to these results, the effectiveness and availability are demonstrated in this paper.

[7] An Eye Blink detection System For Virtual keyboard has been proposed by the authors Afraa Z Attiah et.al (2021).In this Paper The computer's camera is used to capture a facial image, then the eye detection module detects the eye location. Eye blinking is used to select the desired character as the highlighted one on the virtual keyboard like pressing an "Enter" button. The system is designed for people with a disability. The results show high user satisfaction and prove the benefit of the system.

[8] The authors Akihiro Kuwahara et.al (2021) has proposed a Eye Fatigue Prediction System Using Blink Detection Based on Eye Image. In this Paper, we demonstrated that using OpenCV for face image normalization can improve the accuracy of blink detection in image processing. It may be due to the increase in face recognition rate by removing information other than the facial expression and reducing the noise caused by the face movement. In fact, we found our proposed system to be practical for real-world product development due to its fast processing speed by using OpenCV and Dlib. On the other hand, if face recognition is not possible, it is still impossible to detect the blink of an eye, so a processing method is needed to compensate for this.

[9] The paper A Fully Automated Unsupervised Algorithm for Eye-Blink Detection in EEG Signals has been proposed by the authors Mohit Agarwal et.al (2022). In this work, they intially studied the problem of eye-blink detection in EEG signals. During their intial time they find that regardless the abundance of research in this area, the applicability of the proposed algorithms is limited due to one or more requirements of multiple EEG channels, EOG channels, user training phase and manual inspection for the robust detection. In this context, they proposed a fully automated unsupervised algorithm, Blink, to detect eye-blinks in the EEG data. They approach self-learns brainwave profiles for each specific user's eyeblinks, and hence does away with any user training or manual inspection requirements. Blink capable of functioning on a single channel EEG accurately, estimates the start and end timestamps of eye-blinks very precisely. They collected four different EEG datasets to evaluate the robustness of algorithm across various EEG headsets, user activities, and eyeblink types, and show that Blink performs with an accuracy of over 98% in all cases along with an average precision of 0.934.

[10] An Eye Blink Based Biometric Authentication System Using an Event-Based Neuromorphic Vision Sensor have been proposed by the authors Guang Chen et.al (2021). This work introduces the first-

ever neuromorphic sensor based human authentication system using the easy-capture biometrics of eye blinks. One neuromorphic sensor such as a dynamic vision sensor can be used to accurately identify and verify users with relatively simple computational processes. The detailed results show that the system is effective and efficient based on different feature selection approaches and authentication models. The system only uses implicit and highly dynamic features of the user's eye blinks at a microsecond level time resolution and at an asynchronous pixel-level vision resolution, which not only ensures security but also avoids recording visible characteristics of a user's appearance. This work demonstrates a new way towards safer authentication using neuromorphic vision sensors. In future works, experiments may extend into the effects of the temporal evolution of human growth or other changes. Also, to improve the system's robustness against attacks, adversarial samples may be added in the future to provide more safety margin.

***TABLE 1*. COMPARISON TABLE**

PAPER	YEAR	TECHNIQUES	WORK-DONE
1. An Innovative Prototype to Prevent Accidents Using Eye Blink Sensors and Accelerometer ADXL330	**2020**	Sensors and Accelerometer ADXL330	The eye blink sensors detect driver drowsiness, while the accelerometer monitors vehicle acceleration.
2. Eye blink Detection system basically for Paralysed patients		Eye Blink Detection Algorithm	tween specific eye blink characteristics and the likelihood of deception, contributing to the development of more effective deception detection methods
3. Multimodel Human-Eye Blink Recognition Using Z-score Based Thresholding and weighted Features	**2021**	(Vertical Head Positioning, Orientation Factor, Proportional Ratio, Area of Intersection, and Upper Eyelid Radius) depicting imperative gen (z score threshold), extracted from the circles uniquely formed from the eyelids landmarks	The work involves developing a multimodal approach for human - eye blink recognition. This includes implementing Z-score based thresholding to enhance accuracy and combining weighted features from different modalities to improve the robustness

			of eye blink recognition
4. Drowsy Driver Detection System Using Eye Blink Patterns	**2022**	Intel Xeon 2.9 GHz CPU for a 320×240 resolution, Av@Car database	The work involves creating a drowsy driver detection system by analyzing eye blink patterns. Researchers develop algorithms to monitor and interpret variations in blink patterns, aiming to reliably identify signs of drowsiness. The system utilizes these patterns to detect potential fatigue in drivers, providing timely alerts or interventions to enhance road safety
5. Eye Blink Count and Eye Blink Duration Analysis for Deception Detection	**2021**	AU45 Detection,Eye Blink analysis	The work involves developing an eye fatigue prediction system using blink detection based on eye images. Researchers create algorithms to analyze eye images, specifically focusing on blink patterns to predict and assess eye fatigue.
6. Eye Blink detection using Monocular System	**2020**	facial feature point tracking algorithm by using particle filtering	The work utilizes a simplified head model, and facial feature points can be tracked by particle filtering. Eyelid motions are detected as the deformation from the reference facial image. The proposed method requires only

			an inexpensive USB camera and required no intrusive and physical markers
7. Eye Blink detection System For Virtual keyboard	**2021**	Human Computer Interaction(HCI)	The computer's camera is used to capture a facial image, then the eye detection module detects the eye location. Eye blinking is used to select the desired character as the highlighted one on the virtual keyboard like pressing an "Enter" button.
8. Eye Fatigue Prediction System Using Blink Detection Based on Eye Image	**2021**	Image Processing, Dlib, OpenCV, EAR,EARM	The work demonstrated that using OpenCV for face image normalization can improve the accuracy of
			blink detection in image processing
9. Fully Automated Unsupervised Algorithm for Eye-Blink Detection in EEG Signals	**2022**	eye-blink detection in EEG signals, Power Spectrum Density, Dynamic Time Warping	The work is to detect eye-blinks in the EEG data. Our approach selflearns brainwave profiles for each specific user's eyeblinks, and hence does away with any user training or manual inspection requirements Blink capable of functioning on a single channel EEG accurately, estimates the start and end timestamps of eye-blinks very precisely
10. Eye Blink Based Biometric	**2021**	NeuroBiometric, DAVIS346	The work introduces the first-

Authentication System Using an Event-Based Neuromorphic Vision Sensor			ever neuromorphic sensor based human authentication system using the easy capture biometrics of eye blinks. One neuromorphic sensor such as a dynamic vision sensor can be used to accurately identify and verify users with relatively simple computational processes

TABLE 2. **ADVANTAGES AND DISADVANTAGES OF RELATED WORKS**

PAPER	ADVATAGES	DISADVANTAGES
1. An Innovative Prototype to Prevent Accidents Using Eye Blink Sensors and Accelerometer ADXL330	Early Accident Prevention, Real -time Monitoring.Customizable Sensitivity, Integration with Vehicle Systems, Data logging and Analysis	False Positives and Negatives, Privacy Concerns, Technical Challenges, Cost and Accessibiltiy ,User acceptance, Maintenance
2. Eye blink Detection system basically for Paralysed patients	Communication Aids, Indepedence, Cost Effective, Non Invasive ,Real - time Monitoring	Limited Communication Complexity, Accuracy Issues, Integration Challenges, Privacy Concerns, Fatigue due to continuous blink
3. Multimodel Human-Eye Blink Recognition Using Z-score Based Thresholding and weighted Features	Accuracy, Robustness, Adaptability, Integration, Feature Importance	Complexity, Computational Overhead, Data Dependency, Limited Generalization
4. Drowsy Driver Detection System Using Eye Blink Patterns	Early Warning System, Realtime Monitoring, Reduced Accident risk	False Positive, Individual Variability, User Acceptance, Technological Limitations, cost, Ethical Considerations
5. Eye Blink Count and Eye Blink Duration Analysis for Deception Detection	Automated Data Collection, Real-time Monitoring, Objective Measures	Dual signaling, False positive and negatives, Privacy Concerns

6. Eye Blink detection using Monocular System	Non-intrusive, Cost effective, Simplicity, Real-time Monitoring	Ambiguity in gaze tracking Limited Depth Perception ,Challenges with glasses and eye makeup
7. Eye Blink detection System For Virtual keyboard	Hands free operation, Gesture Precision, Enhanced Security, Versatility, Natural Interaction	False positive and negatives, fatigues issues, Limited Input Options, Privacy Concerns
8. Eye Fatigue Prediction System Using Blink Detection Based on Eye Image	Early Fatigue Prediction, User Health Improvement, Customizable Alerts, Productive	False Positives, Accuracy issues, Privacy Concerns
9. Fully Automated Unsupervised Algorithm for Eye-Blink Detection in EEG Signals	Efficiency, Scalability, Consistency, Real-time Monitoring	Accuracy, False positives,Complexity, Lack of adaptibility
10. Eye Blink Based Biometric Authentication System Using an Event-Based Neuromorphic Vision Sensor	Highly Personal, Robustness to Lighting Conditions, Real-time Processing	Privacy Concerns, Cost, Vulnerability, Sensitive to Eye health changes

FUTURE SCOPE

Eye blink detection systems will come into use in human-computer interaction, wearable technology, marketing, healthcare, emotion recognition, privacy, learning, gaming, and sports performance evaluation in the future. It is expected that these innovations will improve graphical user interfaces, improve safety, monitor health conditions, offer biometric verification, and make significant improvements to various industries through the analysis of eye blink patterns for beneficial data and applications

CONCLUSION

The conclusion of this paper,we understand the different methods to implement eye blink detection system. And Literature review of object in real time environment and non real time environment using many different approaches.Some of the paper seems quite good like paper[7] ,to make it more advanced we can use predictive speech recognition.Most of the literature survey papers are having privacy issues that can be removed by future techniques too . The main aim of this paper identify an object approx and using different methods and many approaches to get final result.

REFERENCES

[1] Madhumanti Maiti, Tanaya Banerjee, Kalyan Chatterjee " An Innovative Prototype to Prevent Accidents Using Eye Blink Sensors and Accelerator ADXL330", 978-1-4799- 6908-1/15/$31.00 ©2015 IEEE

[2] Milan Pandey, Kushal Chaudhar, Rajnish Kumar, Anoop Shinde, Divyanshu Totla, Prof. N.D. Mali "Assistance for Paralysed Patient Using Eye Motion Detection ", 978-1-5386- 5257-2/18/$31.00 ©2018 IEEE

[3] Puneet Singh Lamba, Deepali Virmani, Manu S. Pillai , Gopal Chaudhary, "Multimodal Human Eye-Blink Recognition Using Zscore Based Thresholding and Weighted Features", International Journal of Interactive MulTimedia and Artificial Intelligence, Vol. 7, Nº4 2021

[4] Taner Danisman, Ioan Marius Bilasco, Chaabane Djeraba, Nacim Ihaddadene, "Drowsy Driver Detection System Using Eye Blink Patterns" , International Conference on Machine and Web Intelligence (ICMWI 2010), Oct 2010, Alger, Algeria. pp.230-233, ff10.1109/ICMWI.2010.5648121ff. ffhal00812315

[5] Sabu George ,Manohara Pai M.M ,Radhika M Pai ,Samir Kumar Praharaj , "Eye Blink count and Eye Blink Duration Analysis For Deception Detection", 978-1-5090-6367- 3/17/$31.00 ©2017 IEEE

[6] Koichi Takahashi and Yasue Mitsukura, "Eye Blink Detection Using Monocular System and its Applications", 2012 IEEE RO-MAN: The 21st IEEE International Symposium on Robot and Human Interactive Communication. September 9-13, 2012. Paris, France.

[7] Afraa Z. Attiah, Enas F., "Eye-Blink Detection System for Virtual Keyboard", 2021 National Computing Colleges Conference (NCCC) | 978-1-7281-6719-0/20/$31.00 ©2021 IEEE | DOI: 10.1109/NCCC49330.2021.9428797

[8] Akihiro Kuwahara ,Kenichi Nakashi ,Rin Hirakawa ,Yoshihisa Nakatoh ,Hideki Kawano , "Eye Fatigue Prediction System Using Eye Blink Detection Based On Eye Image", 2021 IEEE International Conference on Consumer Electronics (ICCE) | 978-1-7281-9766- 1/20/$31.00 ©2021 IEEE | DOI: 10.1109/ICCE50685.2021.942768

[9] Mohit Agarwal ,Raghupathy Sivakumar, "Blink: A Fully Automated Unsupervised Algorithm for Eye-Blink Detection in EEG Signals", 2019 57th Annual Allerton Conference on Communication, Control, and Computing (Allerton) Allerton Park and Retreat Center Monticello, IL, USA, September 24-27, 2019

[10] Guang Chen, Member, IEEE, Fa Wang, Xiaoding Yuan, Zhijun Li, Senior Member, IEEE, Zichen Liang, and Alois Knoll, Senior Member, IEEE, "NeuroBiometric: An Eye Blink Based Biometric Authentication System Using an Event-Based Neuromorphic Vision Sensor", IEEE/CAA JOURNAL OF AUTOMATICA SINICA, VOL. 8, NO. 1, JANUARY 2021