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A Survey on Secure Eye: Blink-Based Morse Authentication

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Abstract: *Real-time password authentication methods are widely used by people, but they can be exploited or defeated with the help of a hot track or high-speed scan. By using blinding hand motions in place of visible fingerprints, pin verification offers a more secure method of password entry. The procedure of blinking the eyes while taking many picture frames and coming up with a PIN is known as blink-based authentication. This paper provides a range of real-time applications that combine instant-based PIN, facial detection, and One-time Passwords to eliminate shoulder-to-shoulder and scratch tracking.*

Keywords: Eye blink, HAAR Cascade, HOG Algorithm, PIN Authentication, Morse code

I. INTRODUCTION

Our daily lives are now impacted by the Internet, with all services now being accessed online. Apart from engaging in risk-free activities like reading the news, obtaining information, and so on, we have also grown accustomed to riskier tasks like making credit card payments, checking and writing emails, utilizing online banking, and so forth. We acknowledge the advantages, but we run the risk of getting hurt.

Finding an eye's location throughout a video frame is called eye tracking. Another thing that might be more interesting is how the eye moves about the head. Product design, cognitive science, psychological analysis, and visual systems are among the fields where eye tracking is crucial for study and development. To measure eye locations and movements and correlate the results to the same eye across consecutively captured images across time, an eye-tracking system integrates several devices and related programs.

People must authenticate themselves using traditional knowledge-based methods, such as passwords, daily, therefore security criteria for common terminal authentication systems include ease of use, speed, and security. These methods, however, are not secure since they can be watched by malevolent observers who gather user authentication data by shoulder-surfing that is, watching a user type a password on a keyboard. Furthermore, inadequate communication between users and systems leads to security issues. To prevent shoulder surfing, the researchers developed a three-layered security framework for PINs. This framework allows users to enter their password by just blinking at the proper symbols in the right order. Eye blinking is a natural way for people to interact, and eye blink monitoring security systems offer a promising way to improve system usability and security. This study aims to review methods or fixes for handling eye blinking in security systems.

For numerous applications, including managing funds in Automated Teller Machines (ATMs), authorizing electronic transactions, unlocking personal gadgets, and opening doors, the usage of Personal Identification Numbers (PINs) is a widespread user authentication mechanism. Even with PIN authentication, authentication is never completely straightforward, as shown in gateway management and financial systems. The number of ATM fraud incidents surged by 65% in 2022 over 2021, according to Indian ATM Security. PIN entry is susceptible to password assaults like thermal monitoring and shoulder surfing since an authorized user needs to enter the code in public or open areas.

II. LITERATURE SURVEY

This study [1] investigates a novel way to combine real-time eye monitoring and blinking algorithms to improve the security of pin authentication. The increased use of internet services and transactions in today's world has made traditional pin entry techniques vulnerable to security risks such as thermal monitoring and shoulder surfing. The

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suggested method creates a secure pin entry by capturing eye movements and correlating blink patterns across successive image frames. It is built with Python and dlib. In contrast to traditional techniques, this strategy guarantees maximum security by removing all physical evidence, making it resistant to several attempts by unauthorized individuals to get access. The design offers a safe and convenient substitute for conventional pin entry by including facial recognition and dynamic analysis of blink duration. The improved security features and usability of this mind-blowing authentication system are its main advantages. the suggested method provides a more reliable user authentication solution by removing the dangers connected with manual PIN entry, such as shoulder surfing. furthermore, the real-time blinking and eye tracking method's adaptability to various lighting situations shows how reliable it is. the study finds that, despite certain obstacles like the requirement for very precise eye tracking, this novel [1] approach offers a safe and viable replacement for current authentication systems, offering a major improvement in user security and usability.

Using face landmarks and eye blink recognition to transform Morse code patterns through OpenCV, in [2] offers a novel option for those with speech or movement problems. As an affordable substitute for Augmentative and Alternative Communication (AAC) equipment, the system shows its adaptability and highlights its potential uses in private and medical contexts. In comparison to current methods, the suggested methodology greatly shortens the time required to complete tasks, highlighting the effectiveness and usefulness of this method. As such, it represents a substantial advancement in assistive communication technology with wider applications across multiple domains.

Given their ease of compromise, traditional PINs pose security challenges in our increasingly networked environment. To address this issue, a novel eye blink-based PIN entry method is put forth in this work. The technology can offer enhanced security and resilience against attacks like shoulder surfing by way of non-physical eye blinks. Being able to function in real-time adds to the system's effectiveness. The research [3] emphasizes the need for safe and efficient eye detection systems for improved authentication across multiple domains, highlighting the drawbacks of current approaches and the potential of dynamic approaches like eye tracking. An eye-blink PIN, one-time password generation, and facial recognition are combined in a three-layered security approach that is recommended to even further increase user safety. Such an imaginative method has the power to completely transform internet security with its superior protection against password vulnerabilities and unauthorized access.

The work [4] introduces a comprehensive security framework incorporating user registration, face recognition, login authentication, and password recovery modules. The registration module captures user credentials, storing them securely in a text file, while the face recognition module employs Haar Cascade for object detection, creating a cascade function to identify faces in images. Facial Landmark detection, implemented using the dlib library, provides detailed information about facial features. The login module utilizes gaze-based authentication, converting eye blinks to Morse code for added security. In the event of unsuccessful logins, an alert system is triggered, including sending an email with the hacker's image and setting off an alarm. The password recovery module allows users to reset passwords by inputting a keyword, with the new password encoded through mouse clicks. The integration of Haar Cascade and Facial Landmark algorithms ensures robust face recognition, while the innovative use of Morse code enhances the system's security. The work [4] methodology showcases a holistic approach to biometric authentication, combining front-end and back-end implementations for an effective and secure user authentication system.

A real-time system for pencil installation, eye identification, and pin detection employing a smart camera is presented in this study [5]. Gaze-based verification entails monitoring the center of the eye over time by photographing an eye spot in a series of frames. Morse code, in which numbers are represented by dots and dashes, is used for authentication. Virtual security examines the efficient handling of security data within the system, taking into account the background and user interface while also keeping expenses and resources in mind. The psychological acceptance principle dictates how to weigh safety and utility to get the desired result. The model that has been suggested incorporates a Graphical User Interface (GUI) for user interaction. Pygame or OpenCV can be utilized for this objective. Using the Shape Predictor and the Facial Landmark Algorithm for image processing, the location of the Eye Reader is ascertained. The first stage is to use the facial landmark algorithm to accurately identify the user's face. The algorithm searches the region of interest for an eye after detecting a face. High-resolution pixels are captured using a webcam. The system interprets a person's blink as input even if they only have one eye. The facial landmark method is used by the system to process the input when it detects an eye blink. Morse code is used for password setting and reset. For facial detection,

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68 linkages are visualized using a pre-trained model called shape_predictor_68_face_landmarks. The study [5] presents two-factor authentication, which improves password security by fusing mouse clicks and visual-based authentication.

An inexpensive wearable technology based on the Internet of Things, Morse Glasses helps people with speech problems communicate, especially those suffering from motor neuron illnesses such as ALS. Effective communication is made possible by this less amount of technology, which tracks eye blinks and converts them into Morse code. For patients in underdeveloped nations, the Morse Glasses system offers an affordable option. It consists of a wearable glass, a controlling circuit, and a mobile application. The [6] system's capability for a wider range of disabilities could be expanded through future additions that include machine learning for speech prediction, suggestions, and auto-completion. By promoting independence and productivity in their daily lives, the objective is to empower people with disabilities.

In [7] presents a novel method for integrating real-time eye tracking with a smart camera to improve the security of personal identification numbers (PINs). In addition to underlining their susceptibility to numerous attacks, including shoulder surfing, the study highlights the drawbacks of conventional, static authentication techniques like passwords and PINs. Using a smart camera with a 12mm lens and a Gigabit Ethernet interface, the suggested system uses sophisticated algorithms for eye identification and tracking. The project's goal is to reduce security vulnerabilities related to physical PIN-entering techniques by offering a gaze-based, hands-off PIN entry system. The project's main focus is on the algorithms that use template matching and Hough transformations to identify irises, detect edges, and detect eyes. The integration of these algorithms with real-time tracking of user eye movements is made easier by the LabView software. The study highlights how important it is to use non-contact PIN-based verification to improve authentication system security. The study also explores how the suggested approach may be used in a variety of contexts, such as ATM transactions, device unlocking, and electronic transactions, providing a thorough and safe substitute for conventional authentication techniques.

The work [8] developed an eye blink sensor is used to create a customized home automation system for patients with paralysis, particularly tetraplegics. For paralyzed people, an infrared sensor is used to detect intentional eye blinks, enabling them to operate a variety of electrical items and send emergency SMS alerts via an Android app. By offering them an efficient and accessible way to interact with their environment, the suggested solution seeks to enhance the quality of life for people who are physically challenged. The study approach consists of two main parts: a receiver module with an additional microcontroller and relay board to carry out actions depending on detected eye blinks, and a wearable glass frame with an IR sensor linked to a Bluetooth module and microcontroller for data gathering. When the system was tested for accuracy in various lighting scenarios, the results were encouraging and could have benefits for paralyzed individuals who want more independence in their everyday lives.

Using Internet of Things technology, the research study [9] focuses on creating a system for vehicle diagnostics and drowsiness detection. Several algorithms are used in the proposed system, such as a Convolutional Neural Network (CNN) technique for eye blink detection, an algorithm based on Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM) for classifying driver behaviors through sensors, and a combination of machine learning and deep learning techniques for facial and eye detection. Additionally, the study combines support vector machines with algorithms like neuro-fuzzy systems and Wavelet Network Classifier (WNC) for non-intrusive drowsiness diagnosis based on physiological indications like heart rate and EKG. Additionally, a low-intrusive sleepiness detection system using Field-Programmable Gate Arrays (FPGAs) and sensors such as infrared sensors to watch human eyes in real-time and identify bright pupils is discussed in the paper. To monitor driver conditions, prevent accidents, and provide timely alerts and diagnostics information, the suggested system combines these algorithms with IoT technologies, a Raspberry Pi, and a variety of sensors to improve road safety.

This work [10] focuses on surface Electromyography (EMG) signals generated by hand movements for Morse code communication, particularly the time interval between fist folding and fist stretching. The research aims to validate the efficacy of Morse code expression through EMG signals by demonstrating 100% accuracy in recognizing all 26 alphabets (A to Z) through experimental means. The suggested method's adaptability and dependability are highlighted, showcasing its potential applications in security systems, the medical field, and communication tools for individuals with impairments. By offering a simple yet effective means of Morse code communication, this technique expands the

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utility of Morse code in various contexts, thereby addressing communication needs across diverse scenarios and contributing to the advancement of assistive technologies and communication methodologies.

By using OpenCV and Dlib libraries for eye blink identification using facial landmark analysis, this research presents a novel Morse code production system based on eye blinks. To help India's 21 million disadvantaged people especially those with paralysis or speech impairments the device facilitates communication using blinks of the eyes producing Morse code. The method solves the restricted alternatives for nonverbal communication in patients who are paralyzed and is both affordable and patient-friendly. The system's potential is not limited to medical applications; it can also be useful in settings such as libraries, hospitals, schools, and even clandestine communication for military or spy operations. All things considered; it provides a workable [11] answer for people who struggle with communication.

The work [12] presents a novel method for a real-time eye-tracking authentication system with improved security that makes use of Morse code. Using facial landmarks to calculate the eye-aspect ratio, the technology uses a webcam to collect Morse code produced by the user's blinks. The study covers a broad assessment of the literature and discusses the research methodology as well as related efforts in gaze-based authentication, blink monitoring, and Morse code applications. Using a variety of algorithms, including AdaBoost and Viola-Jones, the experimental findings show how accurate the system is. Notwithstanding the encouraging results, difficulties encountered are dutifully noted, including the small sample size and inadequate lighting. This thorough investigation and analysis provide a solid basis for future research and developments on the subject of safe authentication by adding insightful information to the literature, especially in the areas of gaze-based techniques and Morse code integration.

The work [13] introduces a revolutionary eye-movement-based PIN authentication system to ensure safe user authentication. Since traditional password-based systems are prone to vulnerabilities, novel authentication mechanisms are being researched. An eye-tracking device is one of the hardware components of the system, and a software program analyzes recorded eye movement data for authentication. When users select a series of PINs during enrollment, the eye-tracking device collects the matching eye blinks of the users. These patterns are stored as reference templates for later use in authentication. The process is explained in the article about requirement analysis, testing, deployment, security measures, feature extraction, data collection, machine learning model development, and the choice of eye-tracking technologies. Accuracy, reliability, and user comfort are highlighted when talking about modern systems. high degree of precision in the proposed PIN recognition and pupil detection in the system demonstrate reliability and security, paving the way for more advanced authentication systems that are more practical and safer.

The research study [14] introduces a novel method of safe identification that combines facial landmarks and Haar Cascade algorithms with Morse code-based eye blink recognition. The technique attempts to improve user authentication security by fusing gaze-based PIN input with Morse code and facial recognition. The suggested approach adds an extra degree of security through eye blink recognition, which helps to overcome the drawbacks of conventional PIN-based verification. Nonetheless, there may be space for improvement as testers' accuracy in recognizing Morse code differs. Additional improvements might involve streamlining the authentication process for wider use, particularly in government sectors, and implementing facial recognition for every user. The research also looks at related studies on eye blink authentication and makes recommendations for possible future paths, like using finger gesture recognition and combating human shoulder-surfing attacks for advanced security measures.

III. CONCLUSION

A comprehensive review of the literature on eye blinks as a means of authenticating Morse code addresses a wide range of creative methods that are intended to improve security and usability in different contexts. One interesting way to improve pin authentication security and ensure maximum protection against unauthorized access is to integrate real-time eye monitoring and blinking algorithms. The use of OpenCV and Dlib tools for eye blink recognition offers an innovative way to produce Morse code from eye blinks, which can be useful for those with speech or movement difficulties or in covert communication situations. Further improving road safety is the use of deep learning and machine learning methods in eye tracking systems, which provide a holistic approach to sleepiness detection and vehicle diagnostics. In addition, the use of surface Electromyography (EMG) signals for Morse code transmission represents a noteworthy development in assistive communication technology, having implications for medical sectors, security systems, and communication aids for people with disabilities. Overall, these coordinated efforts highlight how

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crucial it is to combine eye blink recognition with Morse code authentication, taking advantage of developments in biometric authentication, computer vision, and machine learning to solve security issues and enhance user accessibility.

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