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MORSE CODE BASED SECURED AUTHENTICATION SYSTEM THROUGH ARTIFICIAL INTELLIGENCE

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Abstract— Data science is a multidisciplinary combination of data inference, algorithm creation and technology to address analytically complex issues, Data science is used by almost all sectors, such as educational institutions, finance, healthcare, business to handle large volume of data. The practical applications range from predicting stock movement to predicting cancer; used in image processing to identity recognition, audio processing for speech to text prediction. An authentication system is required as most of the people in the world are facing problems in the field of authentication and security. It provides a real time eye tracing for password authentication for people who authenticate themselves using Morse code. The webcam is used to identify the user and takes input of the password that is entered in the form of Morse code. The webcam converts the blinks generated by the user into Morse code. When the password matches then the required application is opened.

Keywords— Morse Code , Image processing , Gaze based PIN identification

I INTRODUCTION

Face recognition can also be divided into 4 steps: face identification, face alignment, feature extraction, and eventually face detection.

Face Recognition- Find one or more faces in the picture and use a bounding box to mark them.

Profile Alignment-Normalize the face, such as geometry and picture metrics, to be coherent with the database.

Extracting Feature- Extracting features from the face that can be used for the task of identification.

Face Recognition-Perform face matching in a prepared database against one or more recognized faces.

The first step in developing a blink detector is to perform facial landmark detection from a video stream to locate the eyes in a given frame.

Author has calculated the eye aspect ratio for each eye once they have the facial landmarks for both eyes, which gives us a singular value that relates the distances between the vertical eye symbol points to the distances between the points of the horizontal landmark.

Once they obtain the eye aspect ratio, threshold it to decide whether a person is blinking. When the eyes are open, the eye aspect ratio will remain roughly constant and then will easily reach zero during a blink, then rise again when the eye opens.

Morse code, also known as dots and dashes or dits and dahs, is a telecommunications device that encodes text characters as standardised sequences of two different signal durations.

Samuel Morse, the inventor of the telegraph, is the name of the Morse code. Morse code is normally conveyed using an information-carrying medium like electric current, radio signals, visible light, or sound waves.

The current or wave is present during the time between dots and dashes and is absent during the time between dots and dashes.

Technology has been the driving force of transformation throughout history. Technology has been adopted and integrated into our everyday lives, from the movable form, to television, to the Internet. The overwhelming benefits of technological advances have far outweighed the negative benefits within the systems of civilized society.

With the improved technology comes various ways in which it can make our lives easier and more effective. This led to the emergence of several branches, one of them is Data Science. To put it another way, data science is the analysis of where information comes from, what it means, and how it can be turned into a valuable resource in business growth.

II LITERATURE REVIEW

For authentication, It is recommended that a smart camera be used to implement a real-time system for gaze-based PIN entry, eye tracking, and PIN recognition and monitoring.This approach leaves no signs of physical footprints behind, providing one of the best ways to authenticate the password [1].

In [2] author has suggested that the Passwords can be entered by gazing at the right patterns on the desktop in the correct order using an eye tracker. Shoulder surfing is the method of deliberately tracking a user's keystrokes as they enter a password on keyboard.

Author proposes a new eye recognition and blink monitoring technique in [3] for video frames captured by relatively low web cameras. It uses a Haar-based cascade classifier system with a blend of HOG features and an eye blink recognition

SVM classifier for eye tracking. When tested in a typical room under real-world conditions, the gaze tracking device has a precision of 92.3 percent, and the blink detection tool has a precision of 92.5 percent when evaluated using standard databases.

In [4], the author has worked on the image processing framework, which comprises of a camera and C++ custom image processing, recording and transmitting the eye ball movement image to the Raspberry Pi microcontroller for Open CV processing to obtain the eye ball coordinates, Aging processing module, and wheelchair-controlled module, where the eye ball coordinate is used for gesture control on the Raspberry Pi screen to control the system. In addition to eye movement, the eye blinking is used to enter commands, This device can also monitor certain appliances and send messages to the caretaker's smartphone.

[5] proposes a Morse code transmitting control algorithm which is based on machine learning in response to the Morse message system's lack of reliability and failure to meet the training criteria at medium and low levels.

An advanced webcam based eye blink detection technique was used to determine the degree of drowsiness while driving. The data for this study came from a series of driving simulation observations in which remote cameras were used [6]. Furthermore, drowsiness affects blinking behaviour, and blinking patterns vary significantly, and would need the development of an optimization technique to cope with this intra-individual blink variation.

The author of [7] suggested a number of trials for five ALS patients who were in the early stages of the disease and had lost their ability to speak as well as movement in both their upper and lower extremities. A first group was created to assist them with Morse code by making it easier for them to understand the Spanish alphabet and its mission with each blink. This experiment was conducted in two separate environments, one with low light levels and the other with medium intensity of light.

When a person is tired or sleepy, his eye blinking rhythm varies, according to the writers. The author has used the BioID database for eye detection, and the result was 97 percent positive detection, as stated in [8]. The eye-blink detection result is 87 percent. When applied to automobiles, this approach will dramatically reduce the number of fatigue-related accidents by alerting the driver and allowing him to take extra precautions.

Deaf Vibe, a technology proposed in [9], enables deaf and disable people to interact with others very quickly using touch senses and movements. A deaf person holding the glove feels the vibrations in his or her fingers and recognises the message. A deaf person may use this system to send signals by moving their fingers in the Morse code sequence. The resultant interface is an easy, reduced cost, and wearable solution that deaf and silent people can use in their everyday lives as an efficient communication tool.

According to the authors in [10], the harmful effects are caused by health issues such as Computer Vision Syndrome (CVS) and others. Because of the high visual demand of the screen and the need to concentrate on the work, continuous computer usage causes a substantial reduction in involuntary eye blink rate. The proposed approach creates a prototype using blink as a solution to avoid CVS.

The AdaBoost-based face detection algorithm was developed by the authors in [11], which is a multi-classifier cascade facial recognition algorithm that was studied and can achieve real-time facial recognition. It is an algorithm for automatically generating cascade classifiers during the training phase, which effectively prevents the phenomenon of over-training.

The method for face recognition and eye extraction from frontal face images was suggested by the author in [12] using morphological processes and Sobel edge detection. Preprocessing, face area identification, and eye extraction are the three stages of the proposed procedure. Image resizing and grayscale image transformation are done in preprocessing. Sobel edge detection and morphological operations are used to identify face regions. In the final step, eyes are separated from the face region using morphological operations.

The author suggests that the eye blinking patterns be segmented from the entire video clip to reduce noise. The shapes and locations of the upper eyelid are calculated and visualised on the eyelid location graph during blinking sequences using a polynomial curve fitting algorithm. The eye blinking patterns can now be easily understood thanks to the graph. In order to test patterns, eye blinking parameters are determined, and an eye blinking period is divided into three stages, as shown in [13] : 'Closing Phase,' 'Closed Phase,' and 'Opening Phase.'

The author of [14] used machine learning to develop a control algorithm for Morse message transmission with various requirements. It developed a framework for calculating the transmission rhythm of traditional messages and real-time control messages based on the proportion of dots, dashes, and intervals, as well as two machine learning models. When applied to the Morse message system, it makes the message more versatile, reliable, and effective for freshmen in Morse training.

Keystroke dynamics is a behavior-based biometric authentication system that is an automated method for identifying and verifying an individual's identity based on the way and rhythm of passwords typed on a keyboard by the individual. The aim of the authors in [15] is to find the best algorithm for implementing an authentication framework that uses machine learning to identify users based on keystroke dynamics. For the dataset used, our proposed model using XGBoost has a higher accuracy of 93.59 percent than the other algorithms.

III METHODOLOGY

These are the various methodology adopted by different authors.

The Steps involved in Real-time Eye Tracking Algorithm are [1]:

Step 1: Image Acquisition: The smart camera automatically acquires a raw image.

Step 2 – Image pre-processing: The acquired raw image is transformed to a grey image, which is also converted automatically by a smart camera.

Step 3 - Eye Detection: The user's eye is first identified using template matching. A template from the S is compared to the given image using a matching metric in template matching. The matching metric is a measure of similarity between the two versions. As the template match ranking, this similarity is translated into a numerical value.

Step 4 - Edge Detection: If the eye is detected, a new Region of Interest (ROI) covering only the eye is removed to minimise the processing area. An edge detection technique is applied to the current ROI to locate points around the ellipse or circle of the eye.

Step 5 - If at least 3 points (for the circle) or 4 points (for the ellipse) are found, the circle or ellipse of the eye will be drawn.

Step 6 – If the eye ellipse/circle is drawn, the camera's processor calculates the centre coordinates and saves them for later use in the spreadsheet. The centre of the rectangle

bounding the observed eye is used to calculate these coordinates.

One more way of eye tracking and blink detection system adopted by authors in [3]are:

Capturing image- The first step is to take pictures of the video frames. A frame array is used to store the video recorded.

Face detection and extraction - The image frames captured by the web camera contains the user's faces along with the background. As a result, it's critical to identify and remove the consumer's face in each frame.

Extraction of the eye area - Human face geometry is used to do this. The arrangement of facial features such as eyes, mouth, and nose in the human face follows a geometric proportion.

Eye detection- Eyes are detected from the collected eye areas. Separately extracted and treated are the left and right eye areas.

Speech is converted to Morse code and then to vibrotactile output. Speech must be translated to Morse code and then transmitted as vibration feedback to create a medium for communicating with deaf-mute people. There are two stages to the procedure: Conversions from speech to text and from text to vibration [9].

A different method of eye detection has been proposed by the authors in [8]. The eye is detected using a viola-jones cascade classifier algorithm, and then the eye-blinking rate is calculated. To do so, first decide when your eyes should be open and closed. Set a 60 percent threshold for open eyes to be considered open, i.e. if at least three-fifths of the eyes are open, the eyes are considered open. Calculate the pixel values of certain coordinates of the detected area to detect this openness. The iris, cornea, and lid of the eyes all have different pixel values. Using the pixel values of the identified eyes, determine the openness of the eyes. Finally, they equate the observed eye blink rate to the real eye blink rate, which has been set as a threshold value.

The webcam is attached to a Raspberry Pi microprocessor, which not only conducts digital image processing but also communicates with other modules such as appliances, wheelchairs, and SMS management. Another Arduino is used to receive commands from the Raspberry Pi through wireless communication, and the Arduino will switch the relay on or off in response to the order. Controlling the eye location The mouse cursor position is regulated by the position of the eyeball [4].

Controlling the eye location The mouse cursor is regulated by the direction of the eyeball. The following is the eyeball location algorithm and it is depicted in Figure 1.

1.Determine the average position of eyeball

2.Detect the current position from Hough circle detection.

3.Determine the motion direction of eyeball

(a)Turning left if -60<x<30

(b)Turning right if 30<x<60

(c)Turning up if -30<y<-50

(d)Turning down if 30<y<50

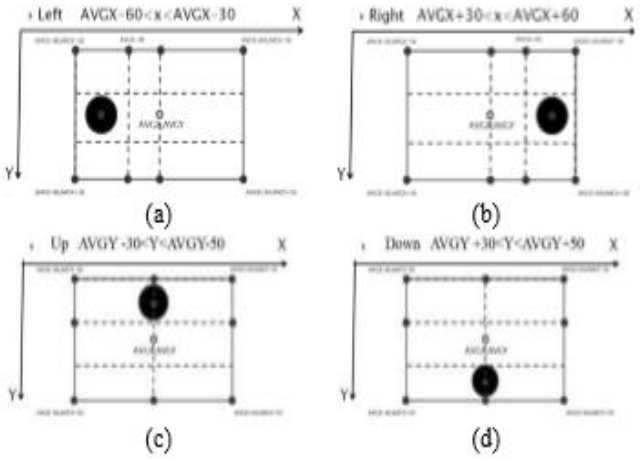

Figure 1: Eyeball motion direction in order to control the wheel chair

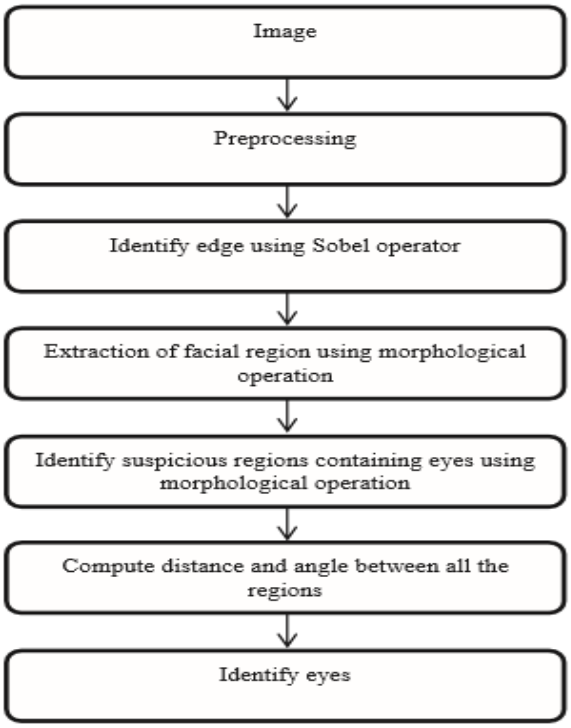

Figure 2 : shows the steps used in the sobel edge detection method including three stages .

Preprocessing is the method of converting a colour picture to a grayscale image. Image resizing and grayscale image transformation are done in preprocessing. Sobel edge detection and morphological operations are used to identify face regions the entire procedure of sobel edge detection algorithm is shown in Figure 2.

Edge detection technique has been applied to a grayscale image in order to locate the edges of a human image in order to distinguish foreground and background.

Extraction of eyes - On a dilated image, a morphological closing operation with a diamond structuring feature is used to enlarge the foreground boundary region and shrink the background region.

Experiments were carried out with five separate trials using a webcam with a resolution of 640 x 480 pixels. Following that, the observed eye is clipped, and different algorithms are evaluated using the threshold method and the difference between the upper and lower eye frames. Recall and accuracy are two performance metrics that are used in the assessment process [10].

The user must first register in the frontend by supplying a user id, a password (PIN), and a keyword. After completing the

registration process, the user will log in using their credentials, which include their user id and password. The PIN is taken as input in the form of Morse code using a web camera.

The entered PIN is compared to the stored PIN that was entered into the database by the user during registration in the backend. If the PIN entered is incorrect, the screen will close. It displays successful authentication if the entered PIN is right. If a user forgets his password, he can use the keyword to authenticate himself and replace his old password with a new one. With security questions, you'll be able to update your password.

IV RESULTS AND DISCUSSIONS

The authors have used various database

The use of real-time eye tracking as a method of password authentication. A new application for gaze-based PIN recognition has been developed using a smart camera-based eye-tracking device [1].

Figure 3: sample of Orl database used

The proposed work achieves the best precision results for Canny, gradient, and LoG, but not for direct white pixel count .

An ordinary consumer grade CMOS sensor web camera with a 640480 pixel resolution provides the video frames for processing. The user's video is captured at a rate of 5 frames per second by the web camera. After that, a Haar-based cascade classifier [3] is used to detect the face in the picture. Three photographs of each of 20 people were chosen from the database for research. As a result, 60 images from the database were used in total and a few samples of Orl database is shown in Figure 3.

For the purpose of testing 3 images each of 15 persons were selected from YAle database as shown in Figure 4.

Figure 4: Sample of Yale database used

Face is detected from the image using Haar based cascade classifier which is as shown in Figure 5.

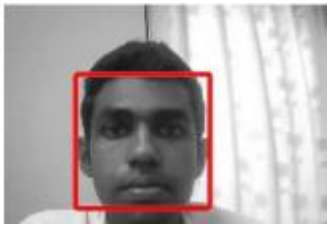

Figure 5: Face detected from the frame using Haar Cascade Classifier

The geometrical properties of human face are computed, in the face image as in Figure 6 shows that it is extracted from the video frame and the left and right eyes are separated.

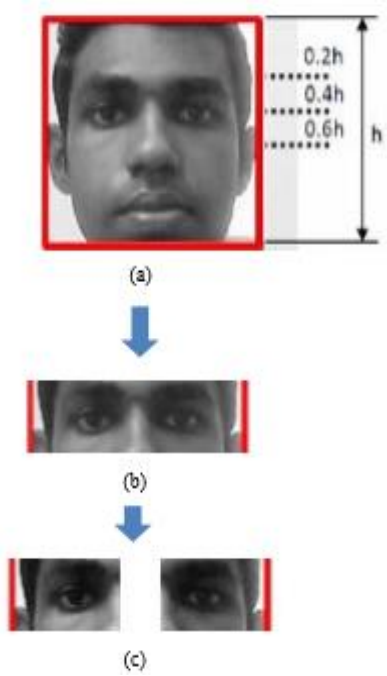

Figure 6: (a) Geometrical ratios of the detected face (b) extracted eye region (c) Left and Right eye regions separated

Each of the selected images in the database was subjected to the eye tracking algorithm, and the results were collected. The accuracy of the eye tracking algorithm is described below in the Table 1.

Table 1:Accuracy of eye tracking algorithm when tested on AT and T database and Yale database

Dataset	No of images used	No of correct classifications	No of wrong classifications	Accuracy (%)
AT & T database	60	52	8	86.6 %
Yale database	45	45	0	100 %
Total	105	97	8	92.3%

Figure 7 (a)original image after resizing (b)Gray-Scale image

Since the edge detection technique is based on grey scale images, a colour image is converted to grey scale and used as the colour space model as shown in Figure 7(a) and (b).

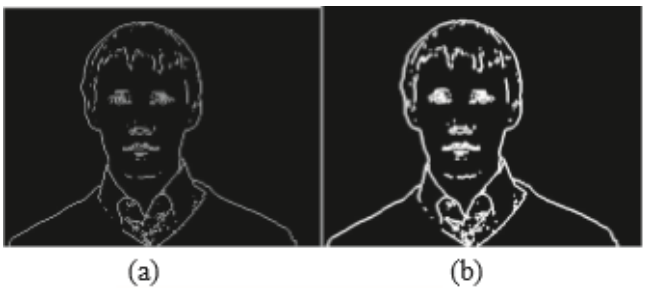

Figure 8 (a) Edged Image (b)Dilated image

Since the edges of this image are thin, morphological dilation is applied to the edged image to thicken them both the edged image and Dilated image is shown in Figure 8(a) and (b).

Table 2:shows the accuracy of the face detection.

Database name	Image used	Correct result	Accuracy
IMM frontal face	120	120	100 %
FEI face	75	75	100 %
IMM face	40	39	97.50 %

Face detection in the IMM frontal face and FEI face databases is 100 percent accurate. Out of the 40 images in the IMM face database, 39 have correct results which is shown in Table 2.

The proposed approach, like the EOG signal analysis method, will evaluate eye blinking patterns qualitatively. This approach also overcomes the drawbacks of the EOG signal, which is restricted in its application due to the need for electrodes and the inconsistency between eye blinking and eyeball movement [13].

To achieve reliable performance, a high-quality microphone is used to reduce background noise and echo. Additionally, Google Speech Recognizer was introduced to help with accent variations. Switching from voice to vibrations and hand gestures to voice worked well, though there was a 10-second pause [9].

With the aid of Matlab and a microprocessor, a method to determine the drowsiness of a person driving a vehicle has been developed. The findings are very persuasive, with an eye blink rate accuracy of 87 percent and an eye candidate detection accuracy of 97 percent.

To make this an efficient operation, make sure the vehicle can't start until the proposed system is fully functional. The disadvantage of this approach is that the individual is unable to wear spectacles. Also, the camera used must be of high quality in order to capture a large number of frames or instances per minute in order to accurately measure the person's eye-blinking rate.

The findings are very persuasive, with an eye blink rate accuracy of 87 percent and an eye candidate detection accuracy of 97 percent. It is possible to reduce the number of injuries caused by drowsiness by using this technique. To make this an effective operation, make sure the vehicle can't start until the proposed system is fully functional[8].

It does not only drive the wheelchair, but also monitor equipment and interact with the caretaker. The eye movement is used to manipulate the cursor that appears on the display, and the eye blink is used to enter commands. But, since the webcam that is connected to the eyeglass is massive, it can obstruct the user's vision. However, this device is good enough to be used by people with disabilities[4].

The Table 3 shows the accuracy percentage of various algorithms used by the authors.

Table 3: comparison of accuracy

Reference no	Algorithm/Method	Accuracy(%)
[11]	AdaBoost	83.2
[8]	Viola jones cascade classifier	87
[10]	Canny,Gradient,LOG	99.5

The accuracies obtained from various models like KNN,SVC, Random Forest, XGB is given in Table 4.

Table 4: Classification Accuracies of The Algorithm

MODEL	ACCURACY
KNN	70.43%
SVC (RBF)	73.98%
Random Forest	87.16%
XGB	93.60%

V CONCLUSION

Various authors have worked on different types of algorithms like Haar casacade algorithm , HOG algorithm, adaptive algorithm, AdaBoost algorithm, Viola jones cascade classifier,in order to process the eye capturing in the system many authors are able to give authentication of around 80-90 percent accuracy,some of the authors have proposed new way of testing. Few Drawbacks are in order to increase the accuracy it is essential to collect more number of datasets of a person .It is difficult to extract and authenticate the person when captured in poor lighting conditions.

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