Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 2175 - 2187
Received 16 February 2021; Accepted 08 March 2021.

Enhanced Systematic Strategy for Biometric Authentication through PIFEA (Pupil and Iris Feature Extraction Algorithm)

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Abstract

This research aims to authenticate a person through his/her biometric traits of pupil and iris. The proposed system will complete the required task using the calculation of chord length of Iris,Pupil, and grayscale values of three middle rows (48, 50, and 52) of a resized (100×100) eye image.The overall work divided as (i) Image Acquisition (ii) Preprocessing (iii) Finding chord length of the pupil (iv) Finding chord length of iris (v) Grayscale values of three middle rows (48, 50, and 52) of a 100×100 resized eye image (vi) Creating Stored Templates (vii) Feature matching. This research used binary information to determine the chord length and required position, determining the pupil's chord length and Iris's Chord length. Furthermore, this work uses grayscale values from particular rows to enhance the proposed work's accuracy because the grayscale value gives more information about the pupil and Iris's textural features.Finally, the proposed system offers 99.92% of accuracy with high performance.

Keywords: Pupil chord length, Iris chord length, Binarization, Grayscale values, and stored templates.

1. Introduction

Iris assumes a significant part in biometric verification due to its generally dependability and uniqueness. Iris affirmation is a methodology for seeing a person by analyzing the iris plan. Iris configuration is outlined by a half year after birth. Iris configuration stays stable after a year and stays the comparable perpetually time infers it does notdevelop. It is seen as the most reliable biometric development since the Iris is significantly specific and definite. The following picture depicts the parts of an eye.

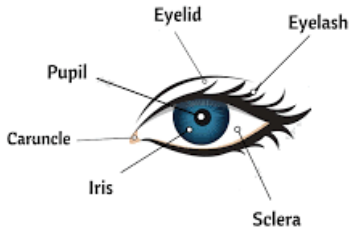

Fig. 1.1: Parts of an eye

Iris instances of unclear twins shift, and iris of left and right eyes likewise have various highlights for a solitary individual. A few biometric scalesare accessible in the human body, such as Iris, finger impression, palm print, face, ear, nose, and toes. Henceforth the Iris kept the primary spot, and the finger impression holds the second spot in its uniqueness [1]. Others have less identity in their highlights [1].The iris authentication is done by carried out

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(i)Image acquisition, (ii)Iris localization, (iii)Iris normalization, (iv)Feature extraction (v) Matching. Some conventional techniques such as Canny Edge Detection Operator, Circular HoughTransform, Daugman Rubber Sheet Model, Daugman Integro – Differential Operator, Wavelet Packets, Fast Fourier Transform, Hamming Distance, Etc. are used in iris recognition for an Authentication.The pupil is a circular/oval area inside an iris. All pupils are not perfectly circular. The pupil's radius, which has a circular/oval shape, will be differing for every person. So pupil is taken as one of the biometric traits in this research. Moreover, the conventional methods for iris recognition are not used because the traditional methods are computationally expensive to reduce the performance. So the proposed system uses a new technique to authenticate a person using pupil and iris structural features.

2. Literature Review

Srinivasa Kumar Devireddy et al. [2] proposed an efficient methodology for recognizing individuals through iris. The creator utilized a homogenization strategy, which uses changing the pixel power estimation of dark-scale iris pictures by fewer than 60 or more 240 to 255. The iris fringe is recognized by applying this procedure. Furthermore,the specularity decreased in the pupil. In iris limitation, the pupillary fringe and limbic fringe are recognized by bearing the methods bit plane cutting, Morphological tasks, and standard deviation windows. At that point, the creator perceives an example of iris from the double piece plane's centerline because the limits close to the limbic and pupil s have some textural blunders. From the twofold codes of the middle column, the creator takes the initial 360 pieces and converts in into hexadecimal mystery code, which has 90 characters.Moreover, afterward, this code is kept in the information base. While design coordinating, this code is removed from the information base. Will supplement it with the determined code of an obtained picture by utilizing the hamming distance strategy. The got picture of an individual will know as an approved individual if the Hamming distance yield is 0.0. Finally, the creator demonstrates the proposed methodology with a precision of 98.7%.

Bimini Jain et al. [3] proposed an effective iris I.D. Utilizing the technique for minutes are descriptors used to recognize the construction and measurements. The creator perceives articles like region, direction, and centroid. The creator used another method called Fast Fourier Transform, which changes the spatial area over to recurrence space and eliminating the commotion from a picture. Finally, Iris's necessary component is recovered and afterward kept into the data set, and after that, it is known as prepared highlights. At that point, the primary examples are recovered for an obtained iris picture and supplement with that put-away element by Euclidean distance formulae. If equivalent outcome met implies it will be considered as coordinating will be done in any case viewed as not coordinated. The creator had accomplished the proposed work with 100% precision.

Khalid A.Buragga et al. [4] proposed a methodology for individual recognizable proof utilizing iris acknowledgment. The creator initially disconnects an iris territory from the got eye picture using the Integro-differential administrator. It is changed over to the dimensional vector then will apply the standardization cycle. After the standardization, the standardized locale is moved Wavelet Packet Decomposition (W.P.D.), and it additionally decreases the execution of highlight extraction. At that point, the required textural designs are recovered by applying a thresholding strategy. The chosen highlights are then applied to an Artificial Neural Network (ANN) for performing characterization. The creator had accomplished the proposed work with 95% exactness.

Nenad Nestorovic et al. [5] proposed an improved model for a proficient and trustworthy iris affirmation framework by generally decreasing clamor in iris layouts. There are two sorts of confirmations accessible today, those are (I) one-one coordinating biometric framework (ii)

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one-many coordinating biometric framework. The primary type accessible for cell phone confirmation, framework validation, and the following kind will be accessible in school. Associations and so forth the subsequent sort generally utilized for verification to make participation, timing the board, and so on in this examination. The creator applies a new method for the first kind. The creator utilizes the CASIA data set for testing. In the iris restriction measure, the creator uses Canny Edge discovery and Circular Hough Transform. By applying these procedures, the creator is effectively distinguishing the iris and limbic outskirts. The creator also builds up another method called Radial Non-Maxima Suppression. Using this procedure, the creator virtually eliminates the commotions made by my eyelids and eyelashes.After that, the Iris is divided by Daugman elastic sheet model here. The round territory is changed over to a rectangular area. After standardization, the necessary highlights are separated by utilizing quick Fourier change (FFT) and arbitrary exhibit. Henceforth the creator demonstrated that the outcomes are bringing out by using FFT is more exact than the Gabor channel strategy. The necessary formats are made layouts are coordinated with arrangements of info iris picture by applying Hamming distance method. The creator had accomplished the proposed work with 100% exactness.

Velapure Amol Suresh et al. [6] present a programmed I.D. by utilizing an iris biometric framework. In the iris I.D., part of analysts used Daugman elastic sheet model for changing over the round territory into the rectangular district. What is more, some creators favored Daugman Integro – Differential administrator for restriction of iris fringe and limbic fringe. Here the creator utilizes the examined methods for standardization and the second one for regulation. In the wake of finding the limits, the creator uses Log – Gabor channel to include extraction. By utilizing the Log – Gabor, the creator effectively channels the clamors and case the necessary layouts. Here the writer isolates a 1D sign to peruse and fanciful parts by utilizing Log – Gabor channels. After that, the made arrangements for accessible iris pictures are put away. The necessary layouts contrasted and the accessible formats in the data set by utilizing Hamming Distance.

Ei Phyu win et al. [7] proposed another strategy to remove an iris's specific textural highlights. In this examination, the entire work is arranged in five stages: picture obtaining, division, standardization, including extraction and coordinating. In picture procurement, the images are recovered from the CASIA (Chinese Academy of Sciences-Institute of Automation) data set. Seven hundred fifty-six pictures for 108 pictures were required progressive long stretches of the same 108 essential images. The picture limitation is done by applying the right strategies to gain an eye picture. In confinement measure, the creator initially uses watchful edge allowance to discover Iris and pupil edges in the wake of applying the Hough change. The calculation introduced in this paper is best to extricate math shapes like bend, line, circles even the picture have to expand and commotion. In restriction measure, the scientists found the center points (x, y) and r (sweep). The center point is known as the directions of a circle, and it will fulfill the condition xc2+yc2-r2=0. After division measure, will apply the standardization cycle, and it is utilizing to eliminate clamors and inconsistence like eyelids, eyelashes, reflections, and a few conditions. In standardization, the specialists use Daugman elastic sheet model. This model believer the roundabout bits of an iris into the rectangular bit to extricate an iris's textural highlights. Here the creator releases the required textural highlights by bear on the idea of one-dimensional article discovery.Furthermore, the second line is drawn on the iris design. What is more, the iris design is changed over alongside the secant line for every pixel, and it is moved into a histogram. At last, the extricated highlights are thought about by utilizing the Euclidean distance strategy.

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Saiyed Umer et al. [8] proposed an orderly strategy for iris distinguishing proof utilizing the nitty-gritty investigation of textural tenseness descriptors. It will not be difficult to perceive iris and related article acknowledgment by using a textural tenseness finder. The general work is arranged into three sections which are (I) preprocessing, (ii) highlight extraction (iii) order. In preprocessing, the principal cycle is picture obtaining ten bears on the morphological tasks like shutting, smoothing, morphological zone sifting the internal limit layer will be showed up. After that, the Reduced Circular Hough Transform (RCHT) is bear on to discover a clear inward limit. At that point, it is considered as a fringe of the pupil. At that point, the remarkable powers are determined in segment and line insightful direction. The significant contrast from the inward locale to the external district is seen as Iris's limit. At that point edge location, morphological is sifting, and the RCHT is bear on to discover clear outer limit. While confinement, Iris's inward fringe and outer fringe are determined. After iris limitation, the iris region is isolated into four quadrants. After separating the iris region, the left and right half of quadrants are considered for the additional cycle. Different quadrants have eyelids and eyelashes' commotions at that point; quarters one and two are just standardized. Standardization is the changing over the round district (Which is in Cartesian directions) into the rectangular area (Which is in polar directions). At that point, the iris designs are recovered from the standardized picture by bear on the idea of Textural Edginess Descriptors (T.E.D.s, for example, H.O.G. [9], SIFT [10], and D.D. [11]. In this examination, the creator proposed three new calculations developed by utilizing T.E.D.'s, here the iris district is separated as patches in the component of n*n to compute the descriptor of a given iris picture (standardized). The distinguished tallying of descriptors utilizing the first calculation is colossal. The second calculation checking of descriptors is decreased by gathering them using the K-implies bunching technique. When utilizing the second calculation, the utilized checking of descriptors will be diminished however the outcome is an exceptionally tremendous measurement. So the creator decreases the element of the result by producing a third calculation. At long last, the recovered textural designs are utilized for characterization. The validation is finished by likeness score between the test tests and the first in the arrangement.

C.S.S. Anupama et al. [12] proposed two separate calculations for validation relying upon iris' textual examples. The primary method includes orchestrating spatial models utilizing vigilant edge identifiers (the generally used picture preparing procedure to identify a given picture) edges. The subsequent practice includes portraying iris signature by bearing on the commonly utilized picture preparing methodology called wavelet change. I can see the clamor in an iris picture because of different brightening eyelashes and eyelids. The creator found the answer for enlightenment issue through the method called Histogram Equalization and Adaptive remainder thresholding for eyelashes. The eyelashes are introduced as a string to diminish commotion by eliminating undermine pixel. Before the execution of restriction, remaining clamors created by eyelashes are taken out by the binarization strategy. The Iris and pupil's outer fringe's round regionis found by bearing the vigilant edge location. After the confinement, the rounded area moved into the rectangular strip called standardization by applying the Daugman elastic sheet model. In the segment of highlight extraction, the creator actualizing two new calculations, which are (I) Feature location through edges (ii) Detection through iris signature. The recovered primary examples are utilizing Euclidean distance and Binary Hamming Distance strategies. At that point, the data sources are reenacted into super code similarity. Finally, the creator did the confirmation with 88.9% precision, and the creator separated circle locale rather than roundabout area.

Snehal S.Sule et al. [13] propose another procedure for Biometric validation utilizing Iris. The creator uses the CASIA data set for looking at the test picture; this contains around 756

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photos with a 640*480 in jpg design. A got eye picture is called a test picture. From the start, the rest picture is fragmented by its limited esteem. On the off chance that forces esteem more than the limit implies frontal area in any case foundation.Furthermore, afterward, edges are recognized by a watchful edge identification administrator. After that, the picture is changed over to a dim scale, and the twofold image relies upon grouping by otsu's thresholding. In the wake of applying thresholding, the Daugman strategy is used for standardization; round Hough Transform recognizes the mathematical boundaries like the circle and square shapes. Limits of Iris and understudy are distinguished effectively by roundabout Hough Transform. At long last, the coordinating cycle is accomplished by hamming distance.

Aly I.Desoky et al. [14] present an iris I.D. calculation by intertwining many eye pictures to shape a layout. The creator proposed another equation by utilizing Hamming Distance; with this new recipe, diminishing memory in the data set will expand and improve the coordinating cycle's proficiency. The outcomes procured from this work give more noteworthy exactness than the past results. In iris confinement, the creator recognizes the iris limit and understudy limit. For division measure in limitation, the Daugman Integro – differential administrator, just as Circular Hough Transform is used to acknowledge iris and pupil edges. A wide range of clamors is eliminated at the hour of restriction. Issues showed up by the various size of an eye picture will be defeated in the standardization cycle by the Daugman technique. Gabor channel, log Gabor channel (or) zero intersection of the wavelet change strategy used to make a layout for the unique mark highlights. At that point, the coordinating cycle is finished by utilizing Hamming Distance (or) Euclidean Distance.

3. Problem Identification

Many researchers are dealing with biometric Authentication bearing the textural features of Iris. Some of the conventional methods are used to accomplish Iris identification tasks. which are Daugman Integro – differential operator [4], [6], [14] Canny edge detection[5], [7], [12], [13] Hough transform [7], Adaptive thresholding [2], [4], [13] Circular Hough transform[5], [13], [14] for localization and Daugman rubber sheet model[2], [6], [7], [12], [13] Artificial neural network [4], Haar Wavelet for normalization and Wavelet packet decomposition [4], Fast Fourier transform [3], [5] for retrieving the required structural patterns from the normalized image.Gabor filter [14], Log Gabor filter[6], [14], 1D log Gabor filter, 2D log gab filter for noise reduction and Hamming distance [2], [5], [6], [12], [13], [14] Euclidean distance[3], [7], [12], [13], [14] for matching the extracted features. Many authors proved that iris identification's efficiency, performance, and accuracy by bearing the above discussed conventional methods, but the discussed conventional methods for localization, Normalization, and feature extraction are mathematically more expensive.Furthermore, many calculations are presented trigonometrically, but matching techniques such as Hamming distance and Euclidean distance are very best and not mathematically expensive. So it is better to finish the iris recognition task using simple techniques, which are using binary information, Grayscale information’s, Hamming distance, or Euclidean distance. Moreover, some new algorithms using binary information and grayscale information can complete Authentication using an eye's Iris's structural features.

4. Proposed Work

This proposed work will recover the problem identified from the literature review. The proposed work will work on pupil and Iris's binary information and grayscale information, so the proposed work's performance will be higher than the previous research. Moreover, the pupil and iris are not in a perfect circle shape. The shape of the Iris and pupil of different person have some minute difference in its oval shape, so the author concludes to find the

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chord length of pupil and iris. Each chord has two points (x_1, y_1) and (x_2, y_2). The required chord length calculated by using the Euclidean distance formula (Distance = Square root ((x_2-x_1)^2+ (y_2-y_1)^2)). The iris' grayscale values are informational, and they will be different for each person. So the author also takes grayscale values of three middle rows of an eye. The overall work divided as (i) Image Acquisition (ii) Preprocessing (iii) Finding chord length of the pupil (iv) Finding chord length of the Iris (v) Extracting the grayscale values three middle rows(48, 50, and 52) of a 100×100 resized eye image (vi) Creating Stored Templates (vii) Feature matching. Pupil, Iris, and Chords' models are depicted in the following picture.

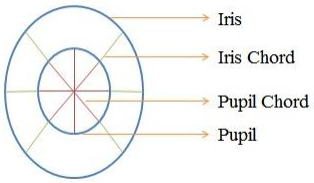

Fig. 4.1: Model of Iris, Pupil, and Chords

4.1 Image Acquisition

The required eye images are acquired from the trained data set CASIA (Chinese Academy of Science and Institute of Automation) and IITD (Indian Institute of Technology Delhi) dataset.One thousand two hundred twenty-seven images are acquired from the described dataset.The collected information about the two discussed databases is briefly explained in the following table.

Attributes/Database	CASIA-V4-Iris-Interval (Left Eye)	CASIA-V4-Iris-Interval (Right Eye)	CASIA-V4-Iris-Twins (Left Eye)	CASIA-V4-Iris-Twins (Right Eye)	IITD (Left Eye)	IITD (Right Eye)
Image Dimension	320×280	320×280	640×480	640×480	320×240	320×240
Image Memory Size	Depend on the image	Depend on the image	Depend on the image	Depend on the image	225 KB	225 KB
Gray Scale Image	Yes	Yes	Yes	Yes	No	No
Image Format	JPEG	JPEG	JPEG	JPEG	BMP	BMP
Number of Classes	249	249	200	200	224	224
Number of Sub Classes	Depend on classes	Depend on Classes	Depend on classes	Depend on Classes	Depend on Classes	Depend on Classes
Total Number of Images	1310	1384	1509	1666	1188	1052

Table 4.1: Information's of Database's

4.2 Preprocessing

Preprocessing of an image is a significant phase in image processing here; the unwanted data are removed and required additional may be added. This section is divided into the following.

4.2.1 Converting the acquired image into a grayscale image

CASIA dataset has grayscale images, but the IITD dataset has colored eye images. The colored images are first converted into a grayscale image using the Matlab function rgb2gray(), and then all the images are stored into a particular directory for cropping.

4.2.2 Resize the image

After converting the images into a grayscale image, the resizing process will be carried out. The acquired images are resized into 100×100. After resizing, it is easy to extract the grayscale value from the specified (48, 50, and 52) middle rows. Moreover, these three rows

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of grayscale information are enough to identify the exact eye image because all the eye images do not have the same grayscale values in the described rows. After the resizing process, the resized images are stored in a particular directory for further process.

4.2.3 Noise Removal

Every acquired eye image has the noises of eyelids and eyelashes. The noises are available at the top and bottom of the eye image. In this research, the author preferred to take the grayscale information of 48, 50, and 52 rows. These rows have efficient grayscale values and have no information about eyelids and eyelashes. So noises are removed successfully by taking middle rows grayscale information.

4.3 Finding the Pupil chord length

The pupil is a small circular/oval shape and in black color presented within the Iris.All pupils are not in a perfect circular shape. It will be the reason for changing the radius of a pupil.That is why this research takesthe pupil's chord length as one of theparts, and this research using only four chords. There is a rare chance of all four chords' length being the same for more than one pupil. An acquired image is converted into a grayscale image(Following Figure) and then resized to 100×100 to find chord length.

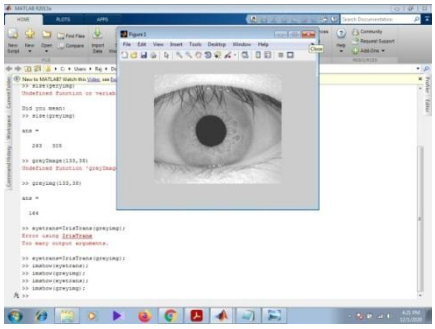

Fig. 4.2: Grayscale eye image

The pixel values less than 90 and greater than 240 are converted into 255 [2] remaining values converted into 130.By doing this, the pupil region is easily separated from an eye image without any noise.After that, binary conversion of an image is carried out to determine the required chord length. The converted binary image is displayed below.

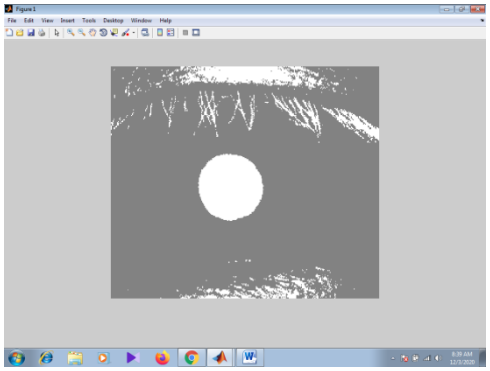

Fig. 4.3: Converted Binary Image

The proposed system will reject the unmatched images at the first attempt. It will save the maximum time.If all the chords length matched well, the next matching process would start.

4.4 Finding the Iris chord length

The pupil boundary position is detected while finding the pupil chord lengths are eight points. In those eight points, six points are used to find three chords length on Iris. Two points for a

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pupil's vertical chord are avoided to remove noises created by eyelashes and eyelids. It is shown in the following figure.

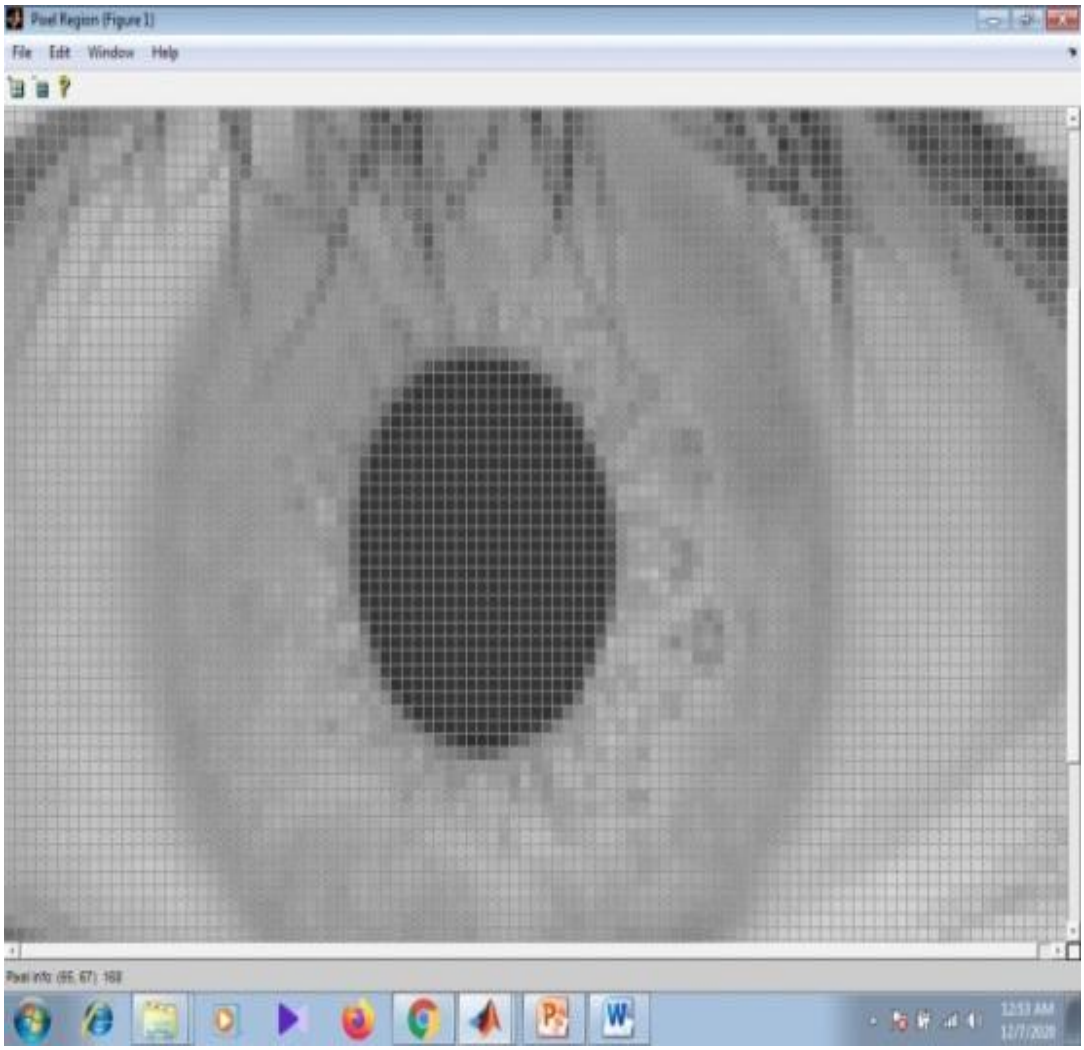

Fig. 4.4: Eyelashes and eyelids noises reflected in Iris area

The vertical chord length is not taken while detecting the Iris code length. Because the Iris has noises like eyelashes and eyelids, it is explained in the last figure. The vertical cord is not used to avoid noise.Because Iris's vertical chord has eyelashes and eyelids data, the other three-chord lengths are enough for an Iris identification.The Iris also may be in the shape of a Circle/Oval. Not all the Irises are in a perfect circle.The Iris chord length matching process will be carried out after matching the Pupil chord length. If the iris chord's length ismatched well, the next matching process will start.

4.5Extracting the middle rows grayscale values.

Many numbers of unmatched images are mostly rejected in the previous two steps.The third step is mainly used to increase the proposed work's accuracy.The grayscale values give more information about the textural patterns. Here the middle row grayscale values (48, 50, and 52) are taken to determine the exact eye image.One row of data is also enough to make a robust matching technique. Another two rows will be taken to lead the proposed system to achieve high-level accuracy.Moreover, the middle row does not have any noises like eyelashes and eyelids.Most of the conventional methods also reject the top and bottom areas to remove the noise.After completing the earlier two processes, the proposed system will handle the third process to increase the accuracy and making a robust extracting technique.

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4.6 Creating stored templates

The detected pupil chord length, iris chord length, and extracted grayscale values of three middle rows are stored as a template. Similarly, the required details are detected from every eye image are stored as templates. Creating stored templates will increase the proposed work's performance because the image preprocessing, finding pupil chord length, finding iris chord length, and extracting grayscale values from the middle rows is done every image earlier and stored as templates before matching. Then stored templates are only enough for the matching process no need to access the database images after creating stored templates and no need to perform required tasks for all the pictures in a database at the time of matching. It will increase the performance and saves time. Finally, one template is maintained for a single eye image.

4.7 Matching the features of an input image with stored templates

After the feature extraction of the input image, the matching process is done by comparing the detected values of the pupil chord length, iris chord length, and extracted grayscale values of an input image with the stored templates. The extracted features of an input image are compared with the stored templates until the match is found.When comparing with the templates, the proposed system first compares the pupil chord length of an input image with pupil chord length stored in the first template. If it is matched well, it will check for iris chord length; if iris chord length matched well, the grayscale values are compared. If any comparison gets failed from the initial comparison, then the next comparisons are skipped for the current template. The proposed system then starts the comparison with the second stored template and so on. If the correct match is found, the access will be granted; otherwise, the entry will be denied.

4.8 Proposed system workflow

4.8.1 Proposed system Workflow for creating stored templates

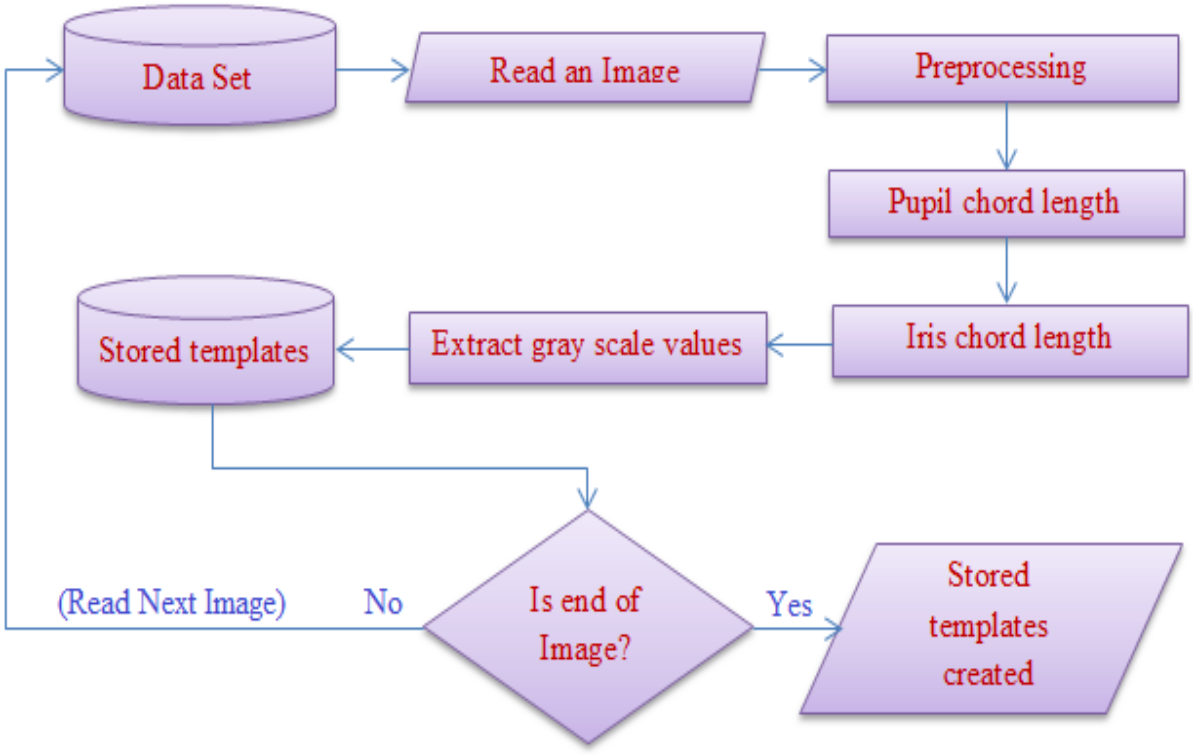

Fig. 4.5: Workflow of creating stored templates

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4.8.2 Proposed system workflow for feature matching

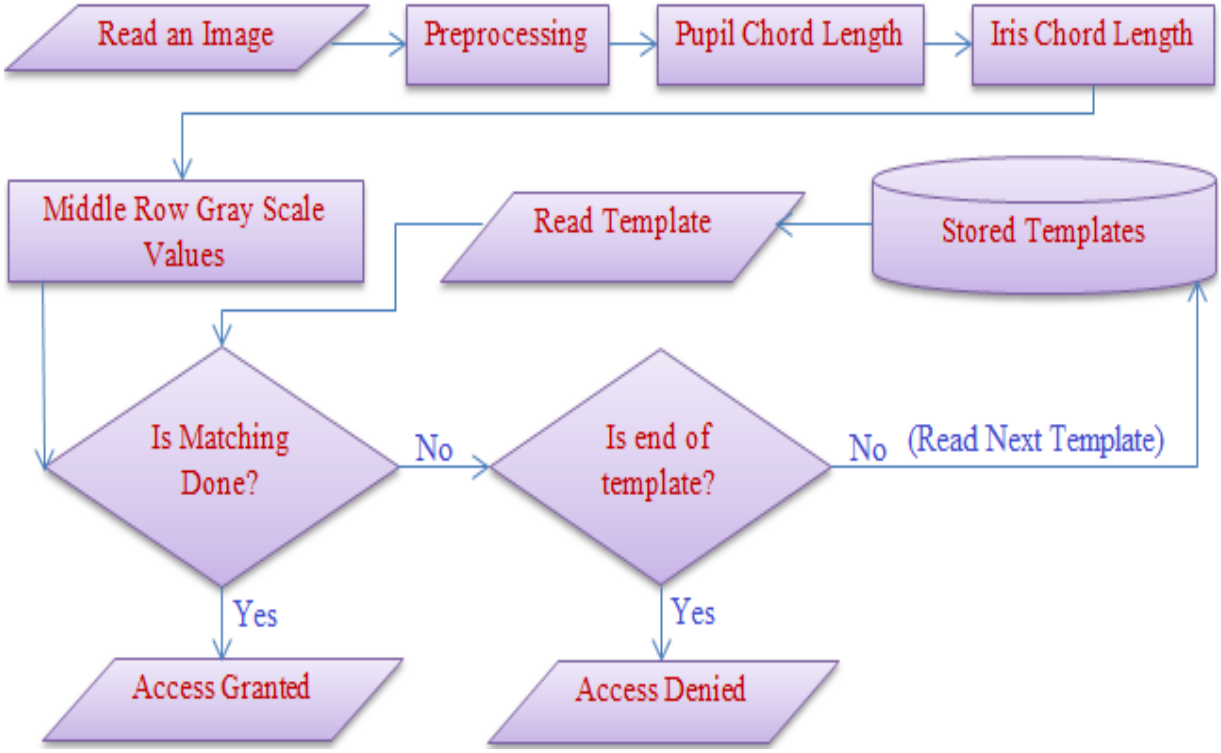

Fig. 4.6: Workflow of feature matching

4.9 Proposed PIFEA (Pupil and Iris Feature Extraction Algorithm)

The proposed algorithm is classified into two categories

- Algorithm for creating stored templates.
- Algorithm for matching input image feature with the stored templates

4.9.1 Algorithm to creating stored templates

Step 1: Start execution.
Step 2: Acquire the images one by one from the dataset and convert them to grayscale if colored.
Step 3: Make a directory for dataset images.
Step 4: Path=”Path of a directory”;
Step 5: if(is not directory of path)
Print ”Folder does not exist”;
return;
end;
Step 6:files = Reading all images from path;
Step 7: for i=1to length(files)
filename=allocate i^{th} file name;
img=imread(filename);
ResizedImg=resize(img,[100,100]);
TransferedPupil=PupilTrans(ResizedImg);
PupilBinary=convert2binary(TransferedPupil);
[c1,c2,c3,c4]=chordLength(PupilBinary);
IrisLength=IrisLength(ResizedImg,50);
RowData1=IrisRowsData(ResizedImg,48);

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```
                Rowdata2=IrisRowData(ResizedImg,50);
                Rowdata3=IrisRowData(ResizedImg,52);
            PupilChordArray=[c1,c2,c3,c4];
                IrisRowDataArray=[RowData1,RowData2,RowData3];
        StoredTemplate{i}={PupilChordArray,IrisLength,IrisRowDataArray};
    end
```

Step 8: End of Execution.

4.9.2 Algorithm for matching input image feature with the stored templates

Step 1: Start Execution
Step 2: img=Read an Input Image
Step 3: grayImg=ConvertToGray(img);
Step 4: ResizedImg=resize(img,[100,100]);
Step 5: TransferedPupil=PupilTrans(ResizedImg);
Step 6: binary=ConvertToBinary(ImFFT);
Step 7: PupilBinary=convert2binary(TransferedPupil);
Step 8: [c1,c2,c3,c4]=chordLength(PupilBinary);
Step 9: IrisLength=IrisLength(ResizedImg,50);
Step 10: RowData1=IrisRowsData(ResizedImg,48);
Step 11: Rowdata2=IrisRowData(ResizedImg,50);
Step 12: Rowdata3=IrisRowData(ResizedImg,52);
Step 13: PupilChordArray=[c1,c2,c3,c4];
Step 14: IrisRowDataArray=[RowData1,RowData2,RowData3];
Step 15: Access="NULL";

```
for i=1 to length(StoredTemplates);
        if(PupilChordArray==StoredTemplates(PupilChordArray))
            if(IrisLength==StoredTemplates(IrisLength))
                if(IrisRowDataArray==StoredTemplates(IrisRowDataArray))
                    Access="Granted";
                else
                    Access="Denied";
                end
            else
                Access="Denied";
            end
        else
            Access="Denied";
        end
    end
```

Step 16: Print(Access);
Step 17: Stop Execution;

5. Implementation

The proposed work was implemented using Matlab R2013a (an image processing software), the most used software for processing image information digitally. Moreover, this software is perfect for matrix operations and mathematical works also. It has several inbuilt methods for processing an image.

6. Result and Discussions

S.No	Dataset	No of Images Used	No of Images	Accuracy in %

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 2175 - 2187
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		for Recognition	Recognized Correctly	
1)	CASIA-V4-Iris-Interval (Left Eye)	197	197	100%
2)	CASIA-V4-iris-Interval (Right Eye)	195	195	100%
3)	CASIA-V4-Iris-Twins (Left Eye)	200	200	100%
4)	CASIA-V4-Iris-Twins(Right Eye)	200	199	99.5%
5)	IITD (Left Eye)	224	224	100%
6)	IITD (Right Eye)	211	211	100%
7)	Total	1227	1226	99.92%

Table 6.1: Results for the proposed work

7. Conclusion

The proposed system works on binary and grayscale values so that the performance will be high. Euclidean distance formula, which is very easy to apply and mathematically not expensive, is calculated using pupil chord length and Iris chord length. Finally,mathematically expensive techniques are not used in this research, and they will give 99.92% accuracy with high performance.

8. Future Enhancements

The proposed system works well and gives more accuracy. The iris structural features also differ in the right and left eye, so this proposed work will be enhanced by combining the textural characteristics of both iris information of the same person. Then it will be unique in biometric Authentication.

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