

A Systematic Review of Finger Vein Extraction and Authentication for Voting System

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Abstract

The requirement for easy, appropriate and reliable validation systems for securing personal information which are stored in electronic devices has firmly improved with the advancement of consumer electronics. The private data can be secured with the help of biometric technology which requires a person's physical, structural or habitual features for personal recognition. The project reveals about the Real Time Finger Vein Authentication System. Finger vein recognition is a biometric technology method which validates using pattern authentication techniques based on photos or images that are captured of a person finger vein patterns which are located under the skins surface. It is a biometric validation technology system that validates with the previously stored vascular patterns or finger vein patterns. The method is very effective and accurate

Keywords: reliable, advancement, technology, authentication, biometrics and vascular

1. Introduction

Present Voting System in India is weak because of the facilities provided by the election commission which takes us to insecurities and inefficiency, but finger vein validation project will provide the required authenticity to provide a fair process. It makes the process protected by utilizing the technology and sources in order to make people follow the law. This will make India a nation which shows interest in rectifying the loop holes present in the system.

Finger vein validation is a method of biometric validation that requires pattern validation methods, approaches and procedures which are related to the pictures of a person's finger or vascular patterns under the skins surface. Finger vein recognition is one among many various forms of biometrics used to recognize individuals and validate their identity. Finger Vein validation is a process of authenticating the vascular patterns hidden inside the fingers of a person. It matches the obtained finger vein data with the previously stored finger vein pattern data.

2.Ease of Use

2.1.Efficiency-

The method is very effective and accurate. Hence, it is believed that in future it will be booming method which can be used in Electronic passport, Airport and Railways Security purpose. Bank lockers and Personal locker, Vehicle Security purposes, ATM's (automated teller machines) and working employee time tracking and attendance tracking.

2.2.Maintaining the Integrity of the Specifications-

The Integrity is obtained as this method is used in Bank lockers and Personal locker, Vehicle Security purposes, ATM's (automated teller machines) and working employee time tracking and attendance tracking.

2.3.Existing System

Personal information is commonly protected by using Passwords, Patterns and PIN's (Personal Identification Numbers). They are very easy to access and have a very high risk of being stolen from the user due to its simple authentication system. Numbers, letters and patterns are very easy to hack, forge and steal.

Biometric technology, which uses physical, structural or habitual features for identifying a person, has allured more and more popularity in the society instead of some old-fashioned technologies which are very sensitive when it comes to providing the safety of a customer. Hence the old technologies are being replaced with the new booming methods for validation of a finger vein.

There are many biometric technologies like Finger print scanner, Face detection, Iris detection, Voice recognition and Hand geometry validation. It's a long list of technologies. All these technologies are equipped with different characteristics like accuracy, low cost, simple, long lasting, size of the data to be stored and security level.

In spite of these handful list of biometric technologies, it is still a dream to name out a proper validation or recognition device which is very secure and reliable in this society. Every technology has its own disadvantages like finger prints can be stolen from a dead person and same goes with palm prints too.

Voice can be copied with help of mimicry or old voice recordings. Patterns, PIN's, passcodes, passwords can easily be seen and remembered by third persons. It is very vulnerable due to its less security systems. Signatures can easily forge by professionals.

3.Knowledge

1. Multimodal biometric authentication system in finger bio metrics which is based on score level fusion - This article has introduced a multimodal biometric check approach dependent on the score-level mix of veins in finger, remarkable engraving, shape of finger and finger knuckle print.

Disadvantages- It works in the coordinating score space as it were.

2. Finger-vein validation which is regarding based on a detector based on wide line and normalization techniques- In this paper, they acquainted a wide line indicator with remove vein designs. It can acquire all the focuses on the lines of vein in the picture and increment the data of the element. We likewise proposed another example standardization strategy, which can decrease the non-uniform mutilations of finger present brought about by fluctuation

Disadvantages- It requires some investment to dissect and comprehend the example.

3. Vascular example of the finger in future- This assessment has focused in on three things basically, the fundamental community point was the arrangement of a sensor which is prepared for getting photos of the vascular case of the finger. The accompanying focus point was the social occasion of a dataset of vascular model photos of the finger to conveyance to the investigation organization and to the affirmation of execution of the current counts. The only remaining focus point was the affirmation of a couple of computations referred to in the composing using assembled dataset and a current dataset

Disadvantages- Vascular innovation is intrusive on the grounds that it makes fear among clients that it very well may be an excruciating cycle.

4. Human Identification on using Finger images- In this paper, they have presented a complete and fully automated finger image matching framework by simultaneously utilizing the finger exterior and interior surface area and subsurface features from finger surface and finger vein pictures.

Disadvantages- Resolution is very low.

5. A technique which is based on Human Identification utilizing Finger vein designs - In this paper, another multibiometric structure has proposed for human affirmation. The proposed techniques used instances of three separate finger veins and solidified them using score level blend philosophy.

Disadvantages- This algorithm without local search mechanism is fragile in local search ability which thus affects the intersection speed and accuracy.

6. Palmprint acknowledgment technique dependent on score level combination- In this paper, they propose a combination plot dependent on score level combination. They initially get the directional coordinating score of the two pictures by the serious coding strategy. Additionally, they get the worldwide coordinating score of the two pictures by the TPTSR strategy. Finally, they join the two scores to characterize the test technique. Finally, they consolidate the two scores to characterize the test tests.

Disadvantage- Palmprint identification accuracy is low.

7. Efficient person authentication based on multi-level fusion of ear scores- A two-stages geometric approach that is both scale and rotation invariant is implemented is implemented for extracting the unique features present in the surface of an ear image.

Disadvantage- Based on ear image recognition.

4. Proposed System.

The finger-vein validation can be an encouraging method in terms of its reliability, safety and availability. The vascular patterns which are hidden inside of the body is deceptive to a normal person's eyes as they require IR light to see the patterns hidden inside the finger. Hence, it is impossible to extract from a dead person's finger and difficult to steal using any techniques.

In finger vein validation, it is not possible that the veins get older with age and gets sculptured like it happens with finger print. Also, it can't be forged like signatures or stolen like passwords, pins and patterns. It also erases the disadvantage of low memory human beings who often forget things easily.

Finger vein validation is highly accurate. It consumes less data size comparatively to the efficiency. It has a very strong and rigid scrutiny and security level. It has the feature of long-term stability.

4.1. Pre-processing-

After scanning the finger in the presence of Infrared light (near IR) and Before going to the finger vein extraction process, we need to pre-process. It is shown in Fig 1.

1) It contains various steps like binarization of the image. It is step 1 in pre-processing where the gray images are converted into white and black images in a binary form as known as 0 and 1.

2) The next step in this process is detection of edges in the picture obtained. Here, with the help of SOBEL detector algorithm for finding edges of the image in order to eliminate the unwanted and useless parts of the image. Area thresholding is applied to eliminate white pixels below threshold. So, that we can concentrate on our main part of the image in the pre-processing process.

3) The third step in pre-processing is called extraction of veins ROI where ROI means region of interest. In this step the important and useful part of the image where the veins can be easily figured out and differentiated before the enhancement process. The irrelevant background details are eliminated.

4) The final step of pre-processing is image enhancement. In this process the image obtained after the ROI extraction is enhanced by increasing the brightness, color contrast and other required fields that describe the quality of image for matching like removing the noise present in the image.

4.2.Flow Diagram-

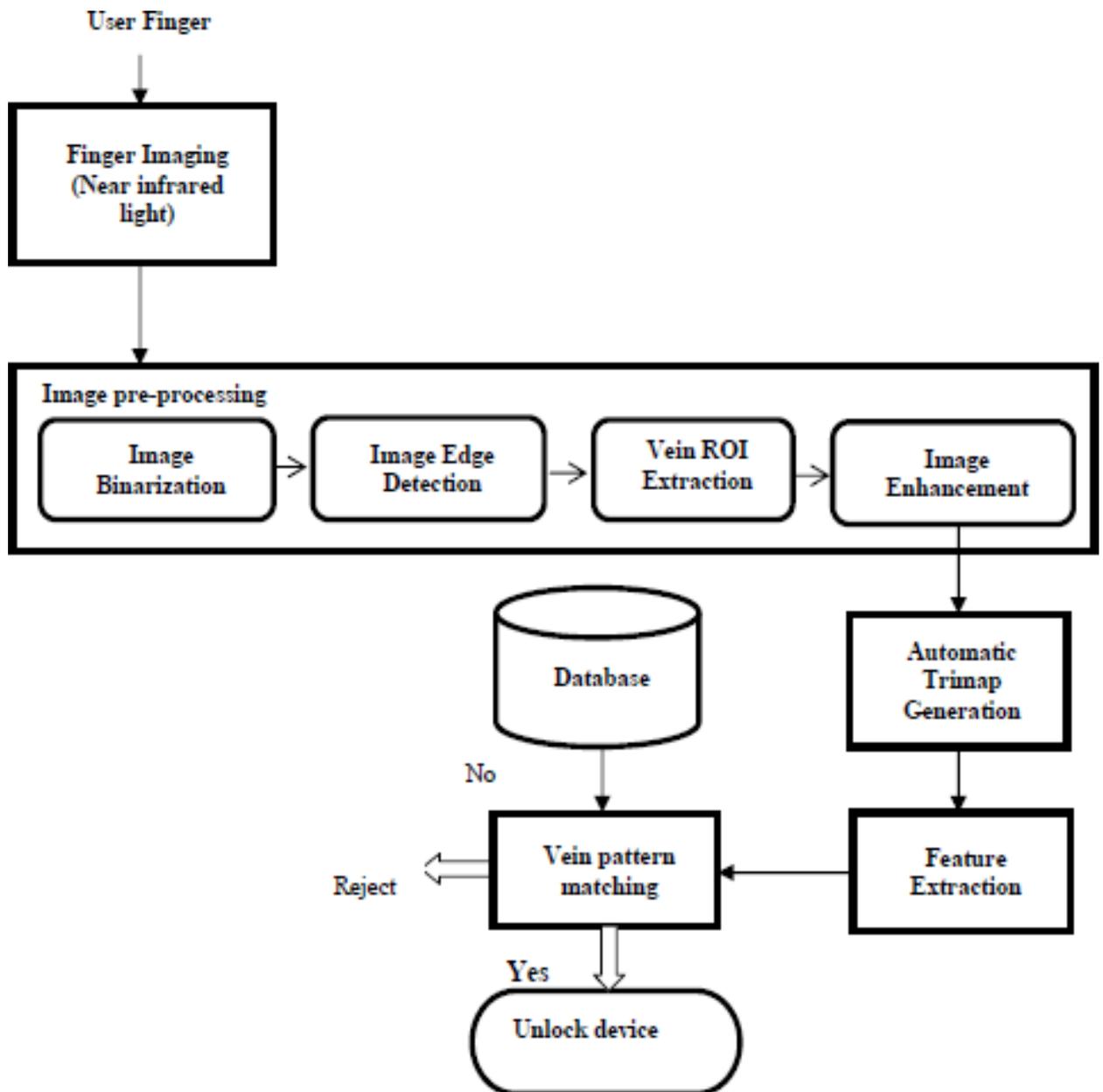


Fig 1. Flow Diagram

4.3.Advantages –

- 1.Finger vein validation system is most accurate among all biometric technologies.
2. Finger vein validation system can be very less invasive in technology.
3. Finger vein validation system doesn't require to touch the scanning machine unlike other biometric systems like finger prints scanner.
4. Finger vein validation system can't be forged from dead persons.
5. Finger vein authentication technology requires less maintenance.

4.4. Architecture Diagram-

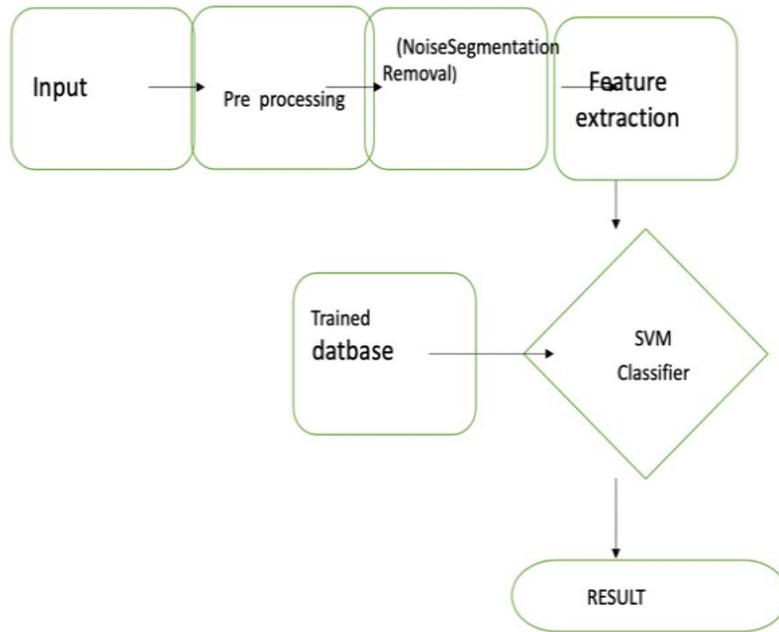


Fig 2. Architecture Diagram

4.5. Block Diagram-

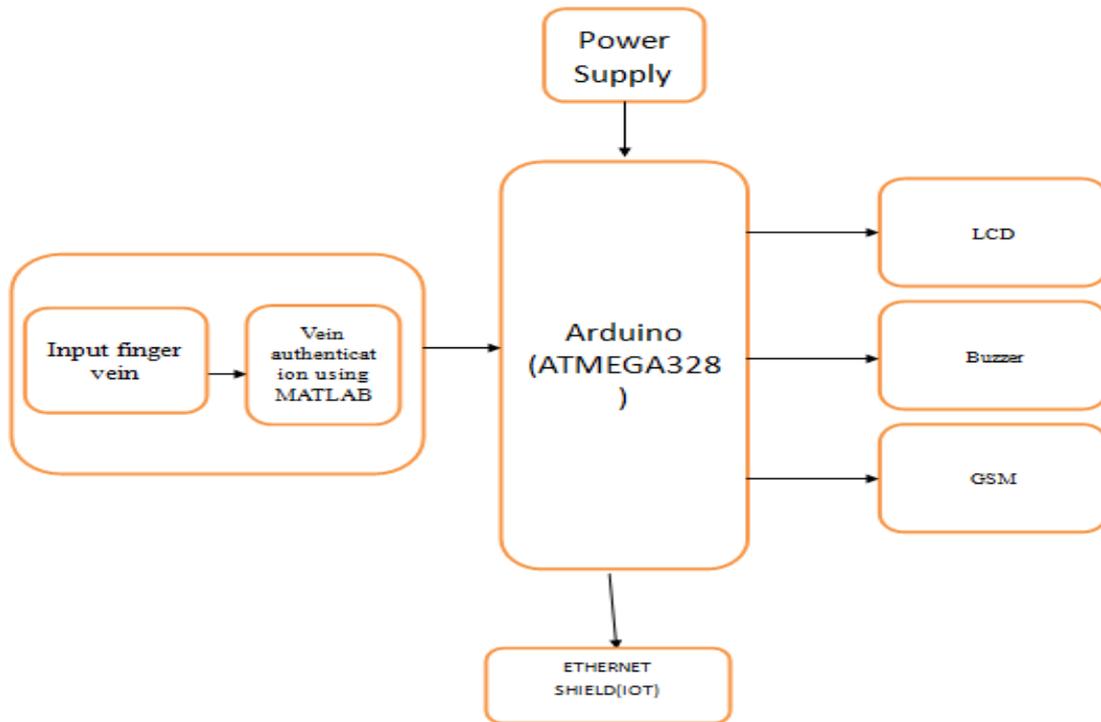


Fig 3. Block Diagram

5.Procedure

- 1)First step: The input images are acquired from the database
- 2)Second process Step: Pre-Processing is done after acquiring the input images of a person’s finger with the help of Infrared light (near IR).

Pre-Processing consists of:

(I) Binarization of the image: It is step 1 in pre-processing where the gray images are converted into white and black images in a binary form as known as 0 and 1.

(II) Edge detection: The next step in this process is detection of edges in the image obtained. Here, with the help of SOBEL detector algorithm for finding edges of the image in order to eliminate the unwanted and useless parts of the image. Area thresholding is applied to eliminate white pixels below threshold. So, that we can concentrate on our main part of the image in the pre-processing process

(III) Extraction of vein ROI: The third step in pre-processing is called extraction of veins ROI where ROI means region of interest. In this step the important and useful part of the image where the veins can be easily figure out and differentiated before the enhancement process.

(IV) Image enhancement: In this process the image obtained after the ROI extraction is enhanced by increasing the brightness, color contrast and other required fields that describe the quality of image for matching like removing the noise present in the image.

(V) Automatic tri-map generation: it achieves good decomposition if pictures which are having less quality of the images extracted during the IR scanning. it is represented as

$$A^{\wedge}(p, q) = B(p, q) a(p, q) + C(p, q) (1 - a(p, q))$$

Where $a(p, q)$ is the pixel's foreground opacity. since b, C is unknown, However, from the provided tri-map, a can b obtained accordingly the equation provided above.

3) Feature extraction:

(I) Repeated line tracking: In this step the veins of the obtained image can be tracked with the help of directions that are preferred using the vertical and horizontal axis. There is no chance of repetition as the starting point is selected randomly from the veins image that is obtained in the pre-processing. Like the name, this process is repeated again and again in different tracks selected randomly.

(i) Even Gabor filter: A Gabor clear out is a linear filter out whose impulse reaction is described via a Gaussian characteristic expanded by means of a harmonic feature.

(ii) GSA set of rules: it is based on regulation of gravity and law of motion. The items loads are obeying the law of gravity as following as: $F_{ij} = G \times M_i M_j / R^2$

(iii) consistent with the Newton's 2nd law, while a pressure F is implemented to an object, the object movements with acceleration a depending at the carried out force and the object mass M as: $a = F/M$

(iv) picture matching- SURF: SURF stands for speed up strong features. it's far a robust local function detection set of rules. it is partly inspired by the SIFT (Scale Invariant characteristic transform) descriptor. The fundamental version of SURF is 3 times quicker than SIFT. SURF is primarily based at the sums of responses acquired from HAAR wavelet and it makes a decisive use of integral pictures.

(II) Cross-Validation: It is a convenient technique used for the classification of data.

(III) Support Vector Machine: A Support Vector Machine is a classifier where the lines hyper lines are formally separated. All the sound sensitive lines are figured by the property closeness. If they are too close it means due to the close points they are sound sensitive and those lines create confusion if not eliminated as they can't be universalized properly.

So, in this method its objective is to figure out those lines whose points are sufficiently far from each other so that the results are accurate. It is a machine learning technique. We know how effective machine learning algorithms are in this contemporary world. Hence, SVM is used in the process of finger vein validation.

(IV) Unsupervised Classification: Here the results are relied on analyzing the software of the picture without giving the sample classes to the pixels that are grouped based on the common characteristics.

5.1. Hardware Used -

1. Arduino UNO (Atmega328)- It is a micro controller where the pre-processes data is connected to. It requires a power supply to run. The data obtained from database is executed and the result is shown with the help of buzzers, led light and GSM. Arduino programs are created and executed in IDE.

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2. Ethernet Shield- It an IOT device which connects internet to things. It provides internet connection to ARDUINO board.

3. LED light- If the data base data is matched with the compiled data, then a green light is displayed from LED light which is connected to the Arduino (ATMEGA 328) micro controller.

4. Buzzer- If the data bases data doesn't match with the scanned data, the buzzer rings and alerts everyone. The buzzer is also connected with the Arduino (ATMEGA 328) micro controller.

5. Global System for Mobile Communications (GSM)- The GSM helps in connecting the internet to the Arduino and provides the facility of receiving and sending text messages. It is sent to the registered message linked to the respective persons unique ID like ADHAR.

6. Analysis

The principle step is related to the underlying advance of picture preprocessing return for capital contributed extraction procedure for finger vein affirmation systems. We used a super-pixel-based breaking point revelation method for ROI extraction, which is solid towards picture assortment, for instance, dim level and establishment upheaval to some degree. In any case, the assessment shows that the super-pixel-based extraction method doesn't thoroughly pick the accompanying point to recognize the finger imit. Additionally, in a huge part of the ROI extraction method there is an issue of vein information mishap. In this way, there is a prerequisite for a solid ROI extraction procedure to vanquish the issue of information hardship what's more, improve the presentation of finger vein affirmation. Besides, normal factors also impacting the idea of the image are picture darkening, non-uniform illumination, low separation, temperature, dampness, sexual direction, thickness of fat, etc Accordingly, debased execution is up 'til now the crucial issue for finger vein affirmation systems. Various standard picture quality evaluation, picture update and recovery strategies have been made to beat these image quality issues. These techniques improve the finger vein picture to some degree as meager thought has been given to components of finger tissue (fat, tissue, muscle, water, etc) which achieve bad quality of finger vein picture. This is as yet an open issue; an acceptable level of affirmation execution has not yet been cultivated. Consequently, even more striking significant learning picture quality procedures are up 'til now expected to deal with the idea of picture.

Collection of Data sets from 15 persons is taken and captured an image with the help of Infrared light. The taken image is pre-processed in four stages as mention in Fig 1. After the enhancement process, the image obtained is extracted using finger extraction classifiers. A total of four different methods has been used to classify the data for matching process. It is sent to the database and compared with the existing data of a particular person. The result is transmitter with help of AT mega 328 microcontroller using buzzer, led light and GSM.

7. Conclusion

This paper provided a comprehensive review on finger vein Authentication. Algorithms were used according to the necessity in the project. A proper source of scanning a finger vein is done with the help of near Infrared light.

Later, the pre-processing of acquired image is done in five complete steps which removes all difficulties and provide a perfect image that is ready for feature extraction. Even in feature Extraction process, we have taken four suitable classification techniques for extraction of data in a required manner. Which includes SVM classifier which is the booming technology in this contemporary world. For matching the SVM classifier is used.

The hardware part Arduino UNO (AT mega 328) microcontroller is well connected with LED light, buzzer, GSM and Ethernet shield. It provides the result in a well classified manner with the help of buzzers, lights and text messages to the respected devices.

The paper gives out the best fresh research developments in the field of Recognition technologies and validations during last 10 years by resolving up with the difficulties that need to be. This idea leads to creation of a unique voting system in the history and provide better and accurate results comparatively. Hence, it makes the Voting process fair.

References

- [1] Kausal Malladi, Srivatsan Sridharan, L.T. Jay Prakash “Architecting A Large-Scale Ubiquitous E-voting Solution for Conducting Government Elections”, in Proc. of IEEE ICAECC 2014, pp.1-4, 10-13 June 2014.
- [2] S. M. Hasan, M. T. Rashid, M. S. S. Chowdhury and M. K. Rhaman , "Development of a credible and integrated electronic voting machine based on contactless IC cards, biometric fingerprint credentials and POS printer" , IEEE (CCECE),2016.
- [3] Bhushan M. Pawar, Sachin H. Patode, Yamini R. Potbhare, Nilesh A. Mohota, "An Efficient and Secure Students Online Voting Application", Inventive Systems and Control (ICISC) 2020 Fourth International Conference on, pp. 1-4, 2020.
- [4] Multimodal biometric validation based on score level fusion of finger bio metrics-Jialiang Penga, Ahmed A.Abd El-Latif b, Qiong Limc, Xiamu Niu c(2014)
- [5] A GSA- based method in Human Identification using Finger vein patterns-Fateme saadat, Mehdi Nasri(2016)