

A Review on Fingerprints Recognition System

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Abstract

This paper is about a current research based on fingerprints recognition system. In this paper, we discuss the previous paper's research on fingerprints recognition system. Paper is a review of security accuracy efficiency and recognition of fingerprints. Fingerprints recognition System widely used in identification tool and biometrics applications. Some fundamental factors also affecting the fingerprints like age and gender. Some human body parts are used for recognition like retina, face recognition, signature, DNA, iris and more. Fingerprints consist of two stages. Data collection and other one concentration on design and implementations. Fingerprints recognition system consists of four steps 1 capture the fingerprints image 2 pre-processing in pre-processing remove the noise and unwanted data 3 feature extraction method to use the different techniques 4 four stage is matching or identification and verification. Security attack occurs in fingerprints system due to some major issue or poor quality. For this purpose, different techniques and algorithms are used. Result and discussion indicate that fingerprints recognition is good for accuracy.

Keywords: Fingerprints recognition; Factor affecting the fingerprints; Security of fingerprints; Accuracy of fingerprints

Introduction

Now a day old security methods password is not accurate and outstanding to protect individual belongings therefore for this purpose used biometrics recognition system. Fingerprints is a consolidation of many ridges and many valleys on the surface of fingerprints ridges are declare as black lines shown in Figure 1 and valley declare as white lines [1-4]. Biometrics of human is splatted into two categories 1 behavior of biometrics 2 physiological biometrics. Every human has its own biometrics characteristics and can be identifying through these characteristics. Fingerprints biometrics system has four basic process or internships that are: collection, extraction, comparison, decision or validation or identification fingerprints recognition system (FRS) requires a comparison or match of his/her fingerprints with the fingerprints in the database to indicate individuals in the storage [3]. Another major purpose of the system is to be used as a security device [5]. In 1899 galton first time explored the feasibility of using fingerprints Recognition system for identifying newborn children it was also possible to use fingerprints to recognize children of 2.5 year age [6]. Automated fingerprints identification system (AFIS) are widely used method for authentication (1:1 match) or identification and duplication 1: N search of individuals 1 and now prevalent around the globe providing and accurate. In modern society fingerprints recognition system is the ability to reliably identify individuals'. A much important application like computer security, financial transaction international border crossing and forensics.

Working and Feature

Fingerprints recognition system is a widely used application and becomes popular and update by the time because manually checking the identity of a person. In the market many techniques are introduced for the recognition with the perspective of human behavior. Biometrics gives us high security that is the reason persistently used for many years and this technique is very simple and easy to use. Biometrics is considering a powerful approach because our ridge and valley surface of fingerprints cannot change and remain the same through a lifetime. Fingerprint recognition is being used for the identification at the several departments as the system security is considered as the most important factor at any department of information and technology.

Initially the user gets register with the system in which the user will provide the basic and personal information which will be required by the system and also the user will provide the thumb impression to the hardware interface which will store the finger print image as well the other information about the user into the database. After the procedure of the registration, the user will only put the finger at the hardware interface; the system will allow the user to get logged in to the system (Figure 2).

Steps for recognize image

Capture image: It's a very first step, in this stage capture the fingerprint through digital sensors look very blur and noisy because the quality of image is not upright [3].

Pre-processing: In the second step make the quality of image better by applying the worth full algorithm, which remove all the damage area appear on the fingerprint such as noisy, missing minutiae, blur etc. and convert it into a high quality image. In high quality image ridge and valleys are properly recognize [3].

Feature extraction: In third step identify the different features of fingerprint. Feature Extraction relies on three levels such as **Level 1:** Global Level (identify the delta, whorl, and loop), **Level 2:** Local Level (check the out of order ridges in most minutiae form. Level 2 worked on Bifurcation, ridge ending, Lake, and Crossover). **Level 3:** Very Fine Level (work on sweat and white pores detected) [3].

Pattern Recognition (PR): In fourth step firstly divide PR into two categories (i) **Decision Theoretic:** In this step quantitative descriptor work with patterns such as texture, area, length. (ii) **Structural:**

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Relational descriptor describe by qualitative descriptor that also focus on patterns [3] (Figure 3).

Most of the enterprises are using the services of fingerprint recognition for the login purpose because the assigning of privileges was a bit difficult in previous technologies. The fingerprint recognition services enables the multiple enterprises where the entrepreneurs can integrate the proper privileges of the system. According to the latest researches, the voting systems should be implemented using the algorithms of finger prints which are less costly as there are a lot of issues about the riggings in the general elections of several countries, so the integration E-voting systems should be most optimized as well as the integrated system should also be based on the correct identification which should be considered as the future work in the field of internet of things and system security (Figure 4).

Literature Survey

Techniques for some problem

Hybrid approach: In this approach Lim and Chin work on the characteristic of fingerprints recognition system through their hybrid approach and this approach based on minutiae recognition for extracting features. This technique is very helpful to minimize the challenges it may occur in fingerprints system. Minutiae techniques consider backbone for this approach. This approach also very helpful when the performance is not good [3].

Novel technique: This approach is for fingerprint matching novel technique depend on two methods one is minutia and another one is a pattern and these methods focus on a feature of fingerprints. The advantage of this technique is input image quality did not affect the performance of fingerprints [3].

Prominent reliable technique: This technique is used to matching the store fingerprint for getting a result. For this purpose we used some technique and algorithm getting the more reliable and secure results [3].

Frequency domain filtering: Frequency domain allows us to exploit some basic features. Fourier transform is related to a characteristic of the image. In particular frequency usually express the rate of change in the image of higher frequency is directly proportional to the higher variation in gray level intensity in the image means to increase the frequency increase to higher variation in gray level [3].

Global Fourier Transform analysis: Take an image $I(x, y)$ where x and y represent the gray level intensity at the pixel of the image.

DFT (Discrete Fourier Transform) of size "M X N" can be computed as shown in equation [1].

$$F(u, v) = \frac{1}{MN} \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} I(x, y) e^{-i2\pi\left(\frac{ux}{M} + \frac{vy}{N}\right)}, i = \sqrt{-1}$$

$$H(u, v) = \frac{1}{[1 + D(u, v) / D_0]^{2n}}$$

where, D_0 is the distance from origin and $D(u, v)$ is a distance of the point (u, v) ,

$$G_k(u, v) = H_k(u, v) \cdot F(u, v)$$

$$E_k = |G_k(u, v)|^2$$

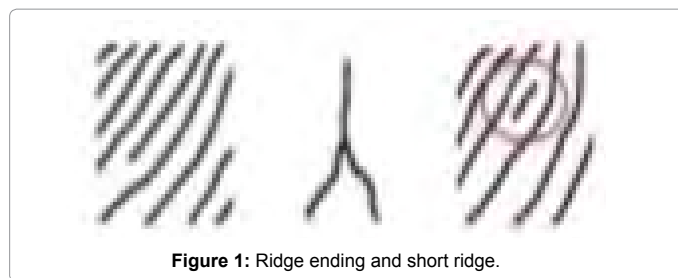


Figure 1: Ridge ending and short ridge.

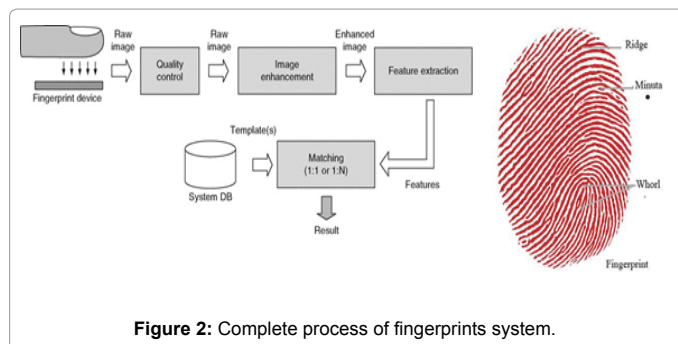


Figure 2: Complete process of fingerprints system.

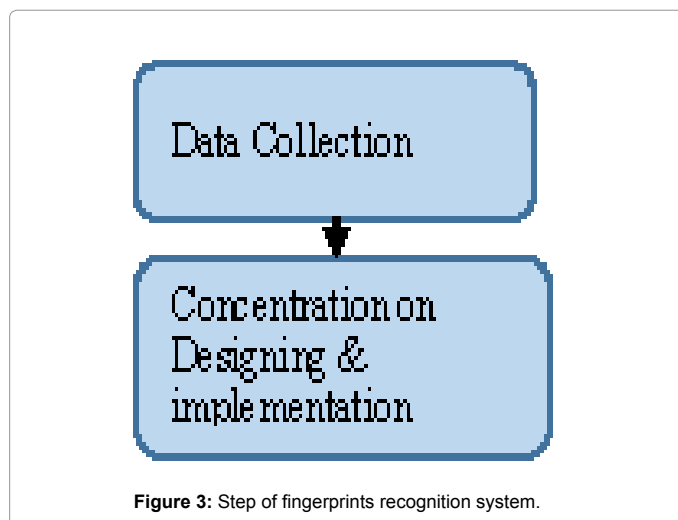


Figure 3: Step of fingerprints recognition system.

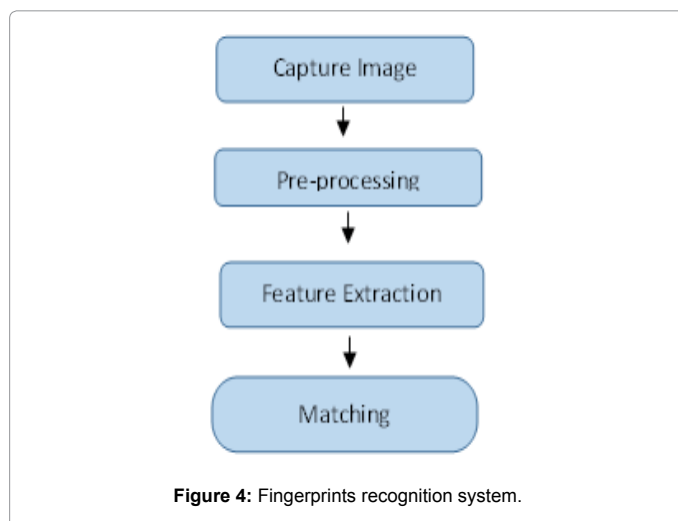


Figure 4: Fingerprints recognition system.

Local Fourier Transform analysis: When FT is applied to the whole image there is no information about which frequencies occur in the entire image at which position in the original image. These limitations can be overcome by using STFT (Short Term Fourier Transform) [1].

Fingerprints matching approaches

Taxonomy of the study: There are a large number of fingerprints matching approaches (Figure 5) and these approaches mainly classified into three type ridge feature based, minutiae-based and correlation based [2].

Correlation-based: The working of correlation-based is matching and calculate different alignment between the corresponding pixels of two superimposed fingerprints images and the correlation-based is applied to the possible alignment as the rotation and also displacement are unknown [2].

Minutiae based: The working of minutiae-based is matching finds the minutiae alignment between the fingerprints to find the maximum number of similarity [2].

Ridge feature based: Ridge feature based is also known as non-minutiae feature based. This approach is the usage of feature extracted from the ridge pattern [2].

Fingerprints analysis method

Kumar et al. designed a fingerprints analysis method which is based on extraction process through minutiae technique. This method improves the image quality to be acceptable for minutiae extraction through combine many processing methods. Minutiae and bifurcation this two method applied to perform the analysis [3].

Architecture of FRS: The architecture of the fingerprint recognition system based on four (Table 1) processes:

Image Acquisition	Image Enhancement
Pattern Recognition	Feature Extraction

Problem with the fingerprints recognition system

Fingerprint may be secure method but one major problem which occur in fingerprints system is security by spoof attack and the other one is poor image quality when the image is poor quality the recognition system do not perform well manners. We should be more detail in this area. More attention on quality fingerprints. We also give more attention in the field of quality and work or research on it. The fingerprints system must be robust when dealing with the quality of fingerprints and it will give better performance in the fingerprint recognition system. And other problem in pre-processing stage in this stage remove the noisy and un-wanted data but noisy data is present in fingerprint image [7-12].

Discussion and Conclusion

This paper give us an overview of fingerprints recognition system Fingerprints is very accurate and reliable technique. Fingerprints recognition system widely used in identification tool and biometrics applications. Biometrics give us high security that is the reason persistently used for many years. We briefly describe the method, approaches and algorithm (indexing algorithm used for efficient search of growing size of fingerprints) of fingerprints recognition system. We also discussed the steps metropolitan police started the use of biometrics for identification. In 1901 in the UK first stage is acquisition stage or

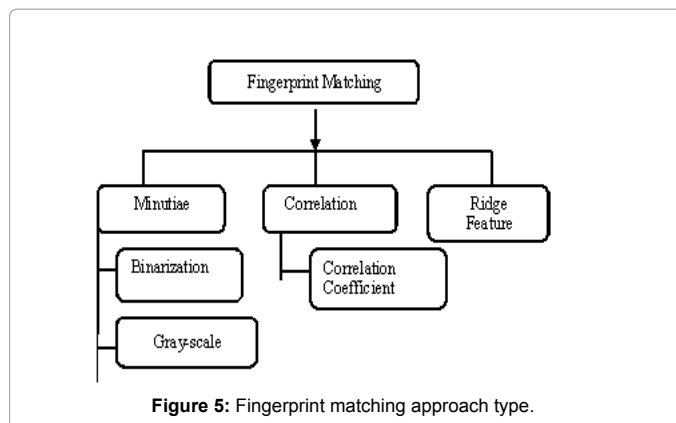


Figure 5: Fingerprint matching approach type.

Name and year	Work
1880 Henry Faulds	Article on Fingerprints published in Nature
1936 Frank Burch	Concept of using iris pattern for human identification
1963 Mitchell Trauring	First paper on automatic fingerprint matching
1973 Takeo Kanade	First AFR thesis
1996 Penev and Atick	Local Feature Analysis
2002 USA	Use of iris recognition in field operations
AD 600 China	Fingerprints to seal contract and legal documents
1924 FBI	Set up its fingerprints identification division
1970 FBI	Initiation of AFIS
1893 Argentina	First use of fingerprints as forensic evidence

Table 1: Some major milestones in the history of fingerprints.

capture, pre-processing (remove the noisy and unwanted data) feature extraction and matching stage for fingerprints recognition purpose with the help of some previous research in detail. In addition we highlighted some security issue which occur in fingerprints approach like spoof attack for this purpose we used fingerprint domain knowledge by extracting local patches centered and aligned using minutiae approach. This approach is able to achieve the significant results. Some basics factors also affecting the fingerprints like age and gender.

Finally, the above discussion and result indicate that Fingerprints Recognition System (FRS) is very good accurate efficient and easy to use technique some problem may occur but these problem can be overcome with the passage of time.

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