Multimodal Cryptosystem Using Feature Level Fusion of Fingerprint And Palm Vein

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Abstract- *For high performance of biometric system multiple modalities are used. In this paper we are using two modalities fingerprint and palm vein. The unimodal biometric system which uses single biometric trait for identification faces some problems like noise in sensed data which gives rise False Acceptance ratio and non universality. Multimodal biometric system overcomes these challenges. This multimodal biometric cryptosystem is a reliable system which improves the accuracy. This authentication system can be used across the various applications such as cyber crime prevention, public aid, security, social benefits, immigration, healthcare identity verification, passport and commercial enterprises use. In this paper, by using two biometric traits we propose a multimodal fusion of fingerprint and palm vein with feature extraction technique such as minutiae algorithm for fingerprint and DWT for palm vein. The extracted features are fused by using feature level fusion. Cryptography is applied to the fused feature vector and then matching is done. The implementation is done using MATLAB, results shows improvement in the performance of multimodal biometrics with RC4 have recognition accuracy of 90%.*

Keywords- Cryptography, DWT, Feature level fusion, Multimodal Biometric, Palm vein.

I. INTRODUCTION

In advance world of today, there is a need of automatic personal identification. For this multimodal biometric system is the best solution. Multimodal biometric technology is more secure and reliable as it uses multiple traits in order to fulfill the limitations of conventional technologies. Enhancing privacy and security of the system encryption is done[4].

The biometric system has many advantages as compared to conventional system. Biometric identification system has more reliability than traditional identification system like key and password. To improve the security several biometric traits are used within a single system called as multimodal biometric system. In this paper, we propose the multimodal biometric system with feature level fusion of face, palm vein and fingerprint. Multimodal biometric system is more secure as it overcomes the flaws of unimodal biometric system. Authentication of a person plays important part for communication in secure way. Multimodal biometric system has more accuracy and reliability than normal systems with password and cards [20].

Multibiometric template contains the information about multiple traits of the same person. Therefore protection of template is an important part of security. Cryptosystem is the technique to secure biometric template. In this paper RC4 algorithm is used for encryption and decryption. Matching is done by minimum Euclidian distance.

II. FUSED MULTIMODAL BIOMETRIC CRYPTOSYSTEM

Multimodal biometric cryptosystem is referred to the integration of cryptography and multimodal biometric system [8]. Here multiple biometric traits are used i.e. palm vein, fingerprint. The block diagram of proposed system is as shown in figure 1. Features are extracted from three modalities with various algorithms such as Minutiae algorithm and Discrete Wavelet Transform. The extracted features from the three modalities are fused by using feature level fusion and then encryption is done with the help of RC4 algorithm. Matching is carried out by using minimum Euclidean distance criterion.

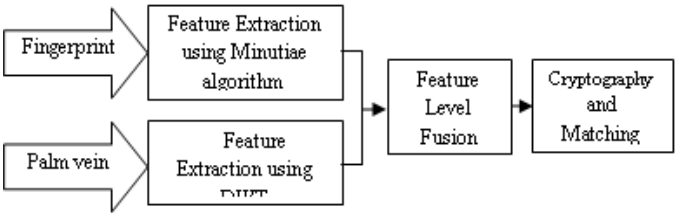


Fig. 1. Block diagram of proposed System.

III. FINGERPRINT RECOGNITION

Finger print is more successful and popular modality. It is a pattern of ridges and valleys on the skin of the fingers. It is most widely used biometric system having low cost. Finger print of a person has unique information and is used for person

identification in legal documents. Minutia is nothing but the points on ridges. Termination and bifurcations are the types of minutia. Ending and branch can be mentioned for termination and bifurcations respectively [4].

The fingerprint feature vector is created as per below steps:

• Minutiae extraction
• Minutiae pre-processing
• Minutiae matching

Fig. 2. Fingerprint

IV. PALM VEIN RECOGNITION

Palm vein is main trait because of the uniqueness property. The pattern of veins remains same through the whole life of human being. Discrete Wavelet transform is used for extracting features from palm vein. When DWT is applied over palm vein image, then four coefficients are extracted such as approximation, horizontal, vertical and diagonal [2]. The Region of interest of palm vein is shown in figure

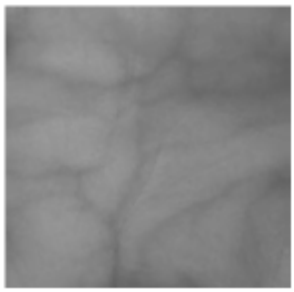


Fig. 3. Palm vein ROI

V.FEATURE LEVEL FUSION

There are various types of fusion such as sensor level fusion, feature level fusion, match score level fusion, rank level fusion and decision level fusion. Fusion is nothing but the combination of two or more feature vector to get single feature vector output [2]. In this paper, we will go with feature level fusion. Feature level fusion is carried out before matching as feature vector contains more information. We can obtain single feature vector by combining no of vectors trough feature level fusion. This level of fusion increases the recognition accuracy [8]. Also fusion gives redundancy free system which increases the system's robustness.

VI. CRYPTOGRAPHY USING RC4

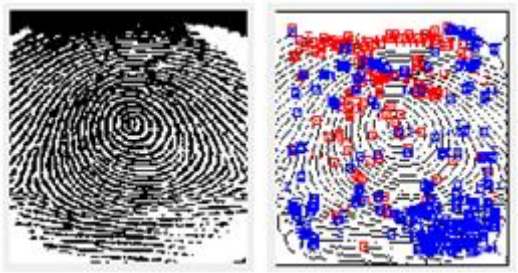
RC4 algorithm is symmetric key algorithm. Identical key used for encryption and decryption. The algorithm uses a variable length key from 1 to 256 bytes to initialize a 256-byte state table. The state table is used for subsequent generation of pseudo-random bytes and then to generate a pseudo-random stream which is XORed with the plaintext to give the cipher text.

The steps for RC4 encryption algorithm is as follows:

1. Get the data to be encrypted and the selected key.
2. Create two string arrays.
3. Initiate one array with numbers from 0 to 255.
4. Fill the other array with the selected key.
5. Randomize the first array depending on the array of the key.
6. Randomize the first array within itself to generate the final key stream.
7. XOR the final key stream with the data to be encrypted to give cipher text.

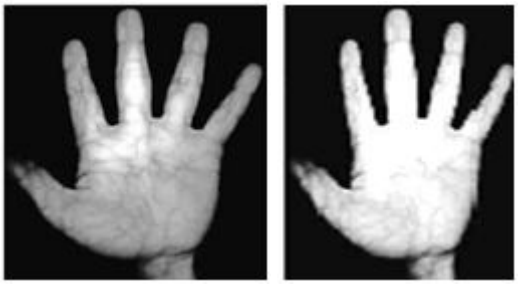
VII. EXPERIMENTATION WITH RESULTS

The methods are implemented by Matlab R2013a (8.1.0.604) on a computer with Intel(R) Core(TM) i3 CPU M370 @2.40GHz, 4GB RAM, Windows 7, 32-bit operating system. The experimental results are shown in figures. In figure 4, fingerprint image is shown



(a) (b)

Fig. 4. (a) Fingerprint (b) Minutiae points



(a) (b)

Fig. 5. (a) Palm vein (b) Enhanced palm vein

The feature vector matrix of fingerprint and palm vein is of the order 521x1 and 512x1respectively. Feature level fusion is applied to the above feature vectors and a fused matrix is obtained. RC4 is used for encryption and decryption. Testing is carried out using 50 images which gives accuracy of 99%.

VIII. CONCLUSION

A multimodal biometric cryptosystem using feature level fusion of fingerprint and palm vein is implemented using MATLAB software. By multimodal biometrics Security is enhanced. Single feature vector is obtained with feature level fusion. Security is further enhanced due to encryption.

In future much better results are expected by using another algorithm, more accurate feature extraction and adding some encrypted key after fusion.

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