Robust Palm Vein Pattern Recognition System Based on Hybrid Texture Descriptors

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Abstract- The robust person authentication scheme based on palmprint biometrics and hybrid cryptographic techniques are used. The security system involves the techniques of steganography , cryptography and pattern recognition. A Biometric system is essentially a pattern recognition system that makes use of biometric traits to recognize individuals. One of the most useful personal biometric is palm print which consists of more sufficient features points for individual unique identification. The system has two phases such as user registration phase and authentication phase. User registration phase is for enrolling person privacy data with their biometric. Next these data's are encrypted using public key type elliptical curve cryptography and this confidential information concealed into person palmprint 2D image using effective steganographic algorithm called bits substitution method. In authentication phase, recognition will be performed through two levels such as password matching and palm print matching. The palm print texture will be characterized using two effective local descriptors Local ternary pattern codes and Gabor filter bank. These combined features are utilized to match input and already stored templates. The two of these authentications is successful then the person gets authenticated otherwise not authenticated. The simulated system shows that a used methodology provides better information security and texture analysis rather than prior approaches.

Keywords - Gabor filter, Elliptic curve cryptosystem, Local ternary pattern, Region of interest, Lifting wavelet transform.

I. INTRODUCTION

Manipulating data in the form of an image through several possible techniques. An image is usually interpreted as a two-dimensional array of brightness values, and is most familiarly represented by such patterns as those of a photographic print, slide, television screen, or movie screen. An image can be process adoptically or digitally with a computer.

To digitally process an image, it is first necessary to reduce the image to a series of numbers that can be manipulated by the computer. Each number representing the brightness value of the image at a particular location is called a picture element, or pixel. A typical digitized image may have 512×512 or roughly 250,000 pixels, although much larger images are becoming common. Once the image has been digitized, there are three basic operations that can be performed on it in the computer. For a point operation, a pixel value in the output image depends on a single pixel value in the input image. For local operations, several neighbouring pixels in the input image determine the value of an output image pixel. In a global operation, all of the input image pixels contribute to an output image pixel value.

II. RELATED WORKS

In [1] Ahmed A.Mona, Ebied M.Hala, Horbaty M.E, and Abdel-Badeeh M. Salem analysis the person identification. The palm vein authentication has level of accuracy because it is located inside the body and does not change over the life and cannot be stolen. The technical aspects of recent approaches for the detection of region of interest (ROI), segment of palm vein pattern, feature extraction and matching. They used the palm vein pattern, ROI extraction feature extraction, matching and very high accuracy. The contactless palm vein authentication technology consists of image sensing and software technology palm vein recognition system consist of infrared palm image capture detection of region of interest and pre processing and palm in pattern extraction, feature extraction and feature matching .palm vein technology works by identifying the vein patterns in an individual palm . When a user's hand is hand over a scanner, a near infrared light maps the location of the veins.

In [2] Bahgat S.F., Ghoniemy S. And Alotaibi M. introduces the concept of biometric authentication technology identifies the person. In the method the account shoulders body characteristics or behaviour are registered in a database and then compared with others. Since veins are internal to the human body, its information is hard to duplicate. Compared with a finger or the back of a hand a palm has a broader and more complicated vascular pattern and thus contains a wealth of differentiating features for personal identification. The multi model authentication technique based on palm veins is a personal identifying factor, to increase the accuracy of security recognition. Palm vein authentication uses an infrared beam to penetrate the uses a hand as it is held over the sensor the veins within the palm of the user are returned as gray lines. As each biometrics technology has its merits and shortcomings, it's difficult to make direct comparison but because vein authentication relies on biological information on the interior of the body

In [3] Baochang zhang, Yongsheng gao, sanqiang Zhao, and jianzhuang liu discussed LDP is a general framework to encode directional pattern feature based on local derivations. The n^{th} order LDP is proposed toencode the $(n-1)^{th}$ torder local derivative direction variation which can capture more detailed information the first order local pattern used in local binary pattern. LBP in nature represents the first order circular derivate pattern of image, a micropattern generated by the concatenation of the binary gradient directions to the best of our knowledge no high order local pattern operator has been investigated for face representation. The PCA representation can hardly capture some variations in the training dataset, such as pose in face recognition. Independent Component Analysis (ICA) takes higher order statistics into account, and is suitable for learning complex structure in the dataset.

In [5] Qin Bin Pan Jian-Fei Cao Guang-Zhong and Du Ge-Guo discussed the vein identification system's identify a certain person by acquiring the local infrared image of hand and extracting vein pattern. The vein identification systems are widely used in security and surveillance filed, but most of them ignore the liveness detection requirement or only check the temperature to prevent spoofing. The vein images are related with vital signs such as oxygen saturation in human blood and heart rate. They can prevent the identification spoofing and improve the security capability of vein identification system.

In [7] Xiangqian Wu, Enying Gao, Youbao Tang and kuanquan Wang was discuss the vein patter. The vein patterns rely on the interior biological information of the body and therefore, cannot be easily damaged, changed or falsified. The vein recognition system which extracts and combines the dorsal, palm and finger vein for personal recognition. The matched distance for decision by employing SVM classifier. The system is tested on a larger database and the result as satisfactory with equal error rate of 0.00223%. However, the traditional token or knowledge based personal authentication. As an important member of biometric family, the vein patterns rely on the interior biological information of the body.

The existing system is the gender recognition is based on ridge and valley features analysis. The statistical features included are principal components and singular values. Random transform and local binary pattern based texture analysis are considered .The disadvantage of existing system are Less performance accuracy due to limited representation of texture, High computational load, RT limits discrimination due to the problem of less resolution and aliasing, Inflexibility and time consuming process.

III PALM VEIN AUTHENTICATION

The person authentication scheme based on palmprint biometrics and hybrid cryptographic techniques**.** Palm is the inner surface of a hand between the wrist and the fingers. Palmprint is referred to principal lines, wrinkles and ridges on the palm. The system has two phases such as user registration phase and authentication phase. The palmprint image will be encrypted using symmetric key chaos encryption. The palmprint texture will be characterized using two effective local descriptors: Local ternary pattern codes and Gabor filter bank. These combined features are utilized to match input and already stored templates.

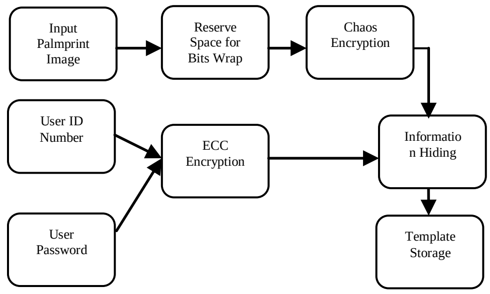
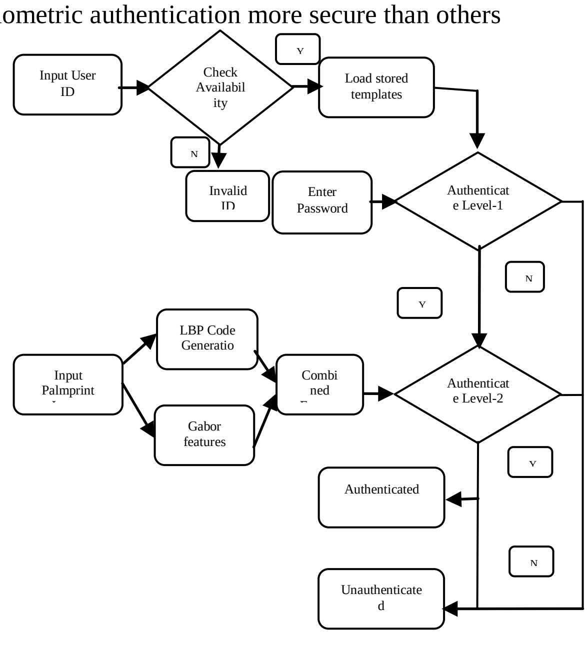


Figure 1 Registration Architecture

A. PALMPRINT RECOGNITION

The biometrics-based mechanized human recognizable proof is now highly popular in a wide range of civilian applications and has a turned out to be intense distinct option for conventional (password or token) identification systems. Human palms are easier to introduce for imaging and can uncover an assortment of data. Therefore, palm-print research has invited a lot of attention for regular citizen and scientific utilization. On the other hand, similar to some of the popular biometrics (e.g., fingerprint, iris, face), the palmprint biometric is likewise inclined to sensor level satire attacks. Remote imaging using a high-resolution camera can be utilized to uncover essential palm-print points of interest for conceivable spoof attacks and impersonation. Therefore, extrinsic biometric components are required to be more powerless for spoofing with moderate efforts. Palm vein authentication works by contrasting the example of veins in the palm (which show up as blue lines) of a person being authenticated with a pattern put away in a database. Vascular examples are special to each individual, according to Fujitsu research even identical twins have distinctive examples. Furthermore, since the vascular examples exist inside the body, they cannot be stolen by means of photography, voice recording or fingerprints, along these lines making this method of biometric authentication more secure than others



B. PRINCIPLES VASCULAR PATTERN AUTHENTICATION

Hemoglobin in the blood is oxygenated in the lungs and conveys oxygen to the tissues of the body through the arteries. After it discharges its oxygen to the tissues, the deoxidized hemoglobin returns to the heart through the veins. These two types of hemoglobin have diverse rates of receptiveness. Deoxidized hemoglobin absorbs light at a wavelength of about 760 nm in the close infrared district. At the point when the palm is lit up with near-infrared light, unlike the image seen by the human eye the deoxidized hemoglobin in the palm veins ingests this light, thereby reducing the reflection rate and causing the veins to show up as a dark example. In vein authentication based on this principle, the region used for authentication is captured with close infrared light, and the vein design is extracted by image processing and registered. The vein example of the individual being confirmed is then verified against the pre- registered pattern.

C. PREPROCESSING

The palm-vein pictures in contact-less imaging present a great deal of translational and rotational variations. Therefore, more stringent pre-preparing steps are obliged to concentrate a stable and aligned ROI. The pre-processing steps essentially recoup a settled size ROI from the procured pictures which have been normalized to minimize the rotational, translational, also, scale changes. This is trailed by the nonlinear upgrade so that the vein patterns from ROI images can be observed all the more obviously. Since the power capacity of a computerized image is only known at discrete points, derivatives of this capacity can't be characterized unless its accept that there is an underlying continuous intensity function which has been inspected at the picture focuses.

LIFTING WAVELET TRANSFORM

The Wim Sweldens developed the lifting scheme for the construction of biorthogonal wavelets. The main feature of the lifting scheme is that all constructions are derived in the spatial domain. It does not require complex mathematical calculations that are required in traditional methods. Lifting scheme is simplest and efficient algorithm to calculate wavelet transforms. It does not depend on Fourier transforms. Lifting scheme is used to generate second-generation wavelets, which are not necessarily translation and dilation of one particular function. It was started as a method to improve a given discrete wavelet transforms to obtain specific properties. Later it became an efficient algorithm to calculate any wavelet transform as a sequence of simple lifting steps. Digital signals are usually a sequence of integer numbers, while wavelet transforms result in floating point numbers. For an efficient reversible implementation, it is of great importance to have a transform algorithm that converts integers to integers. Fortunately, a lifting step can be modified to operate on integers, while preserving the reversibility. Thus, the lifting scheme became a method to implement reversible integer wavelet transforms.

Constructing wavelets using lifting scheme consists of three steps: The first step is split phase that split data into odd and even sets. The second step is predict step, in which odd set is predicted from even set. Predict phase ensures polynomial cancellation in high pass. The third step is update phase that will update even set using wavelet coefficient to calculate scaling function. Update stage ensures preservation of moments in low pass.

Lifting scheme based Haar wavelet transform

Wavelet systems of the Haar have been generalized to higher order dimension and rank. Two types of coefficients are obtained from the wavelet transform. Scaling coefficients are obtained by averaging two adjacent samples. These scaling coefficients represent a coarse approximation of the speech. Wavelet coefficients are obtained from the subtraction of two adjacent samples. Wavelet coefficients contain the fine details of the speech signal. The Haar wavelet is famous for its simplicity and speed of computation. Computation of the scaling coefficients requires adding two samples values and dividing by two. Calculation of the wavelet coefficients requires subtracting two samples values and dividing by two.The inverse transform simply requires subtraction and addition. Using logical shifts to perform division eliminates the need for a complex divide unit. Furthermore, implementing a logical shift in hardware requires much less power and space than an arithmetic logic unit (ALU).

Given the computational requirements, the Haar wavelet is a simple and easy to implement transform. Computational simplicity makes the Haar transform a perfect choice for an initial design implementation. Let us consider a simple example of Haar wavelet: Let us consider that we have a discrete sequence f(x) which is obtained by sampling continuous signal such as speech signal.

Consider two neighbouring samples X and Y of this sequence. These two samples show strong correlation. Haar transform will replace value of X and Y by Average and difference:

$a = (X+Y)/2, \; d = (Y-X)$

Simple inverse Haar transform can be used calculate original value of sample X and Y:

$X = a - d/2 , \; Y = a + d/2$

CHAOTIC IMAGE ENCRYPTION

A direct and obvious way to protect the information from unauthorized eavesdropping is to use an encryption algorithm to mask the information, which has led to the development of various number theories based encryption techniques. Chaos theory has been established by many different research areas, such as physics, mathematics, engineering, and biology.

Since last decade, many researchers have noticed that there exists the close relationship between chaos and cryptography. The distinct properties of chaos, such as ergodicity, quasi-randomness, sensitivity dependence on initial conditions and system parameters, have granted chaotic dynamics as a promising alternative for the conventional cryptographic algorithms. Chaos-based cryptography is relied on the complex dynamics of nonlinear systems or maps which are deterministic but simple.

Therefore, it can provide a fast and secure means for data protection, which is crucial for Multimedia data transmission over fast communication channels, such as the broadband internet communication. Chaos seems to be a good approach due to its ergodicity and complex dynamics.

ELLIPTIC CURVE CRYPTOGRAPHY

Elliptic curves provide good security with smaller key sizes, something that is very useful in many applications. Smaller key sizes may result in faster execution timings for the schemes, which is beneficial to systems where real time performance is a critical factor. So we use ECC for key generation.ECC are performed by mapping the pixel values to Elliptic curve coordinate. For mapping, a separate look up table is required or used the point multiplication operation of pixel value with Generator '*G*' to produce affine coordinate on the elliptic curve. In these cases, mapping table is required while decryption process to generate the corresponding pixel value from the cipher image.

In our algorithm, to work on group of pixels to reduce the number of computation. The group of pixels are transformed into big integer single digits keeping in mind that it should not exceed ' *p*' value which is one of the parameter in elliptic curve equation of finite field. These big integer values are paired and given as input denoted by 'Pm' in ECC operation.

FEATURE EXTRACTION

The standardized and upgraded palm-vein pictures delineate bended vascular network/patterns, and these vessels can be approximated by little line portions which are fairly bended. Along these lines, to use two new approaches to concentrate such line-like palm-vein highlights.

Likewise, a neighbourhood matching scheme that can effectively account for more successive rotational, translational varieties, and also to some image deformations in the acquired image. Keeping in mind the end goal to learn the adequacy and robustness of the proposed approach for the palm-vein identification, it performed thorough tests on both contact-less and contact- based database systematically evaluated and compared every one of these systems together, so that we can get more insights into the problem of palm-vein identification.

For matching the palm prints, we need to extract some features first. The extracted features are then used for matching. A component's portion extraction and coordinating calculations are line based, subspace based, statistical and coding based approaches.

IV RESULT

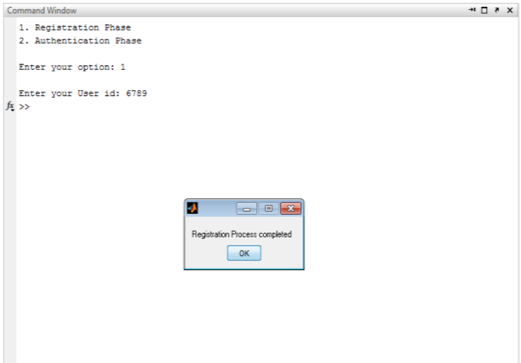


Fig 3 Registration Phase

Fig 3 illustrates the registration process in the database. In the registration process, the user id is entered as a new one. If the registration is successful, the dialog box appears to determine the completion of the registration.

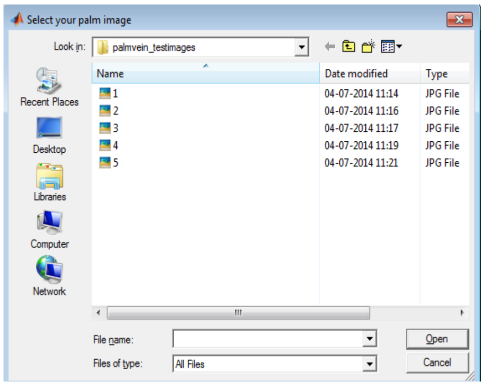


Fig 4 Select Test Image

Fig 4 illustrates the processing of the test image. First the image is stored in the system. Then the image is selected and stored in the database. The image selected describes the image to be tested which is compared with the details provided in the database.

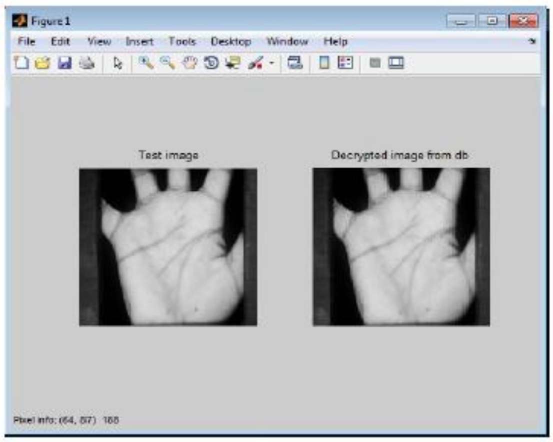


Fig 5 Test Image

Fig 5 illustrates the test image. Here the image is selected and decrypted by means of extracting the veins from the palm.

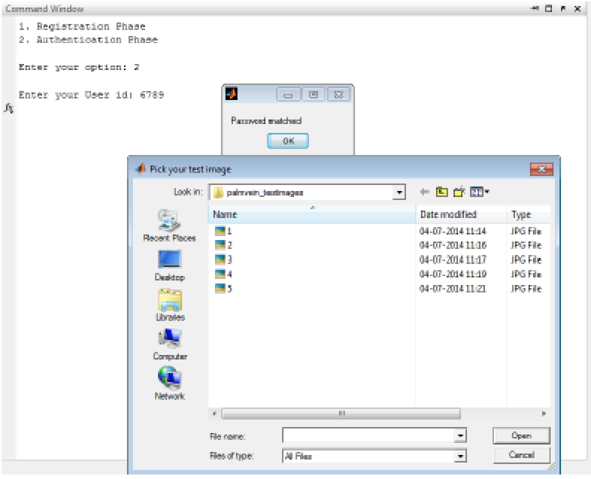


Fig 6 Authentication Phase

Fig 6 illustrates the authentication phase. Here the image is selected and provided with the user is and their image such that they are matched for verification.

Fig 7 Password Detection

Fig 7 illustrates the password detection. Here the password is provided and verified for authorization purpose.

V CONCLUSION AND FUTUREWORK

In the proposed approach, wavelet transform is applied to the palm image and the dominant spectral features have been extracted such as the major lines. The textures are extracted by using LTP and Gabor filter. A palmprint is considered as a texture image, so an adjusted Gabor filter and LTP is employed to capture the texture information on palmprints. This approach helps in increasing the performance and accuracy of the system. The aim of working on the palm print recognition system is to develop a system with increased speed and accuracy.

The Future work will be based on the combination of iris and palm print features for person authentication using Sequential modified Wavelet Transform and Energy feature extraction using key generation analysis. An efficient approach based on multimodal biometrics (Palm print, Iris) based user authentication and key exchange system. In this system, texture properties are extracted from the Palm print and iris images are stored as encrypted binary template in the server's database, to overcome the dictionary attacks mounted by the server. The image processing techniques are used to extract a biometric measurement from the palm print and iris.

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