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Analytical Approach For Privacy Protection By Palm Print Mechanism Using Wavelet Transformation

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Abstract

The prominence of digital image processing domain has been increased from last few decades due to its advanced research areas such as medicine, biometrics, military, robotics etc. In this work an important issue has taken as area of research namely protecting the privacy information from the unauthenticated users either as accidental or incidental ways. Although tremendous progress has been made in the past years on the protecting the privacy information by make use of biometrics namely fingerprint, palm print, iris etc. The usage of palm print in academia, medical labs, and military has been increased from few years but in some scenarios these palm print mechanisms fails to meet the practical requirement. The proposed work presents a novel work where palm print approach uses textural information along with the different wavelet transforms in order to protect the privacy information where the information from different transform techniques is analyzed in terms of individual as well as combined level. Biorthogonal, Symlet and Discrete Meyer are the wavelet transform techniques used in the proposed work for the analysis on the palm images taken from the image acquisition system. Finally when compare with the traditional palm print approaches the proposed palm print algorithms has better genuine acceptance rate i.e. GAR is 97.12%.

KEYWORDS: Palm print, Wavelet, Privacy protection, Authentication

1. INTRODUCTION

In 21st century security has been the major area of concern and to provide good solution to the problems related to security and research on biometrics has increased thrice in the past few years. Nowadays internet related applications have increased a lot and the major issue related to the internet applications are creating authentication from the remote location which creates the security chain. In traditional approaches usage of passwords and tokens have been used which are easily stolen and guessed. To overcome the drawbacks related to traditional algorithms usage of biometric has been increased prominence for authentication and related identification of the respective entities.

The term biometric came from the great GREEK mythology where BIO means life and METRIC means to measure. The science of biometrics mainly relies to develop technological which can provide advance security by taking the persons psychological characteristics into account. The taken users unique characteristics are used further to identity and verify the individual user information in an reliable way. The usage of the internet has been keep on increasing in the day to day life activities and the major question comes to everyone is about security. In order to provide the reliable security approach a personal identification system is required. Generally these personal identification systems divided into two categories as follows.

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S.NO.	Knowledge based	Token based
1	In this type knowledge can be easily guessed	In this type the token can easily stolen
2	In this knowledge can be easily Shared and forgotten	In thisthe token can easily lost
3	E.g. Password:	E.g. Physical key, ID card

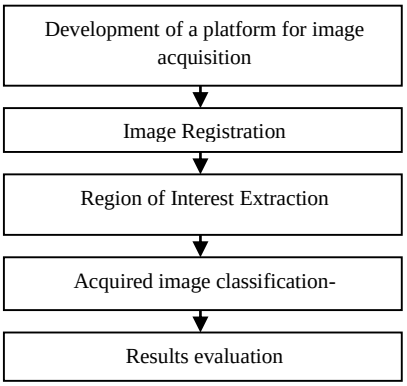

Figure 1: Types of personal identifications systems

Although both the knowledge based approach and the token based approach have the advantages and simultaneously limitations in their own way. These analysis and theoretical representation in the literature indicates the strong alternative for the better human identity management system than the conventional methods.

After tremendous research performed on many sources researchers concluded that the biometrics are the reliable solution to the all existing problems of the human identification system and provide better privacy protection to the data belongs to the respective individual. Biometrics is mainly intended for authentication and identification which are strictly based on physiological and behavioral characteristics. One can able to know the importance of personal identification systems in day to day life and coming to comparison between the Knowledge based and token based are classified as followsTabular column 1: Knowledge based vs Token based

2. PROPOSED METHOD

2.1 Development of the proposed Algorithm

The palm print biometric mechanism is the one of the popular approach used for authentication and verification of the approved user. The following figure depicts the different stages in the development of the proposed algorithm starting from Image acquisition platform development to finally acquired results evaluation in accurate manner.

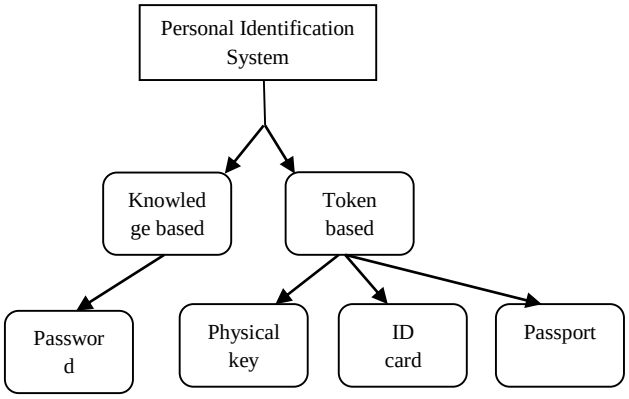

Figure 2: Development of the proposed Algorithm

2.2 Development of a platform for image acquisition

The Palm print acquisition of the respective individual is primary step in the proposed algorithm flow. As reported in literature there are two prominent techniques available for the acquisition of the palm print individually, the respective techniques are namely scanners and pegged systems. The important points about the two existing palm print acquisition systems are as follows

(a) The scanners are not safe in terms of hygiene

(b) The pegged systems cause inconvenience to the user while acquisition.

Due to these drawbacks both palm print systems are fails to gain the user acceptance, as both existing approaches fails to primary biometric norms. As every biometric approach as two good qualities ease of acquisition and good hygienic safety.

The proposed approach is successful to present a novel contact less peg free system and on the other hand it also meets the primary norms of the biometric system.

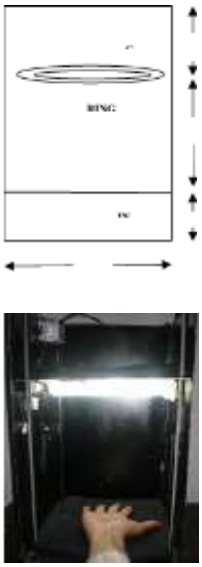

Figure 3: Frontal view of proposed acquisition device

The above figures represents the proposed image acquisition device in frontal view, generally the proposed device comprises of two plates where the upper plate comprises of camera and source light for visualization and bottom plate is used for user.

2.3 User Training

In this section user training is discussed in detail, the analyst ask the user to place his hand flat on the surface of the image acquisition system. The fingers of the user should apart from each other so that the respective user can put his middle finger on the line which is already designed on the surface. This middle finger placement on the line provides the transitional and rotational invariance.

2.4 Image Registration

The important steps in the image registration are as follows

(a) Conversion of Acquired RGB palm print to HIS color model in order to get the desired color parameters.

(b) The hue value is same as that of RGB as skin color is same so it is safely neglected and on the other end saturation value too neglected in negligible way.

(c) The gray level values of palm image are used to get the proposed texture values which retain the information which is further for personal identification.

(d) The color images are changed to gray level are a follows

$$I = (0.2989 \times R) + (0.5870 \times G) + (0.1140 \times B) \quad (1)$$

(e) The gray scale image is converted binary image by using the threshold and normalization process.

(f) In order to tackle the issues like undesirable noise in background and varying variance a novel threshold is used namely Hysteresis thresholding.

(g) The user training ensures a unique palm print which incorporated by rotational alignment to tackle the inadvertent rotations and here we make of second order moment for analyzing the elongation.

(h) The Elongation analysis is used to get the desired eigenvectors and eigenvalues.

(i) Based on the obtained information direction of elongation is determined by using the direction of eigenvalue and again which is further used for to get the desired binarized long line for palm print.

(j) Consequently the theta between the longest line and middle finger is calculated as below

$$\theta = \left[\frac{1}{2}\tan^{-1}\left[\frac{2c}{a-b}\right]\right] \quad (2)$$

Where a, b, and c are the second order moments of the pixels and calculated as follows

$$a = \frac{\sum_{((x,y)\in P)}\{(y-v)^2.P(x,y)\}}{\sum_{((x,y)\in P)}P(x,y)} \quad (3)$$

$$b = \frac{\sum_{((x,y)\in P)}\{(x-u)^2.P(x,y)\}}{\sum_{((x,y)\in P)}P(x,y)} \quad (4)$$

$$c = \frac{\sum_{((x,y)\in P)}\{(x-u).(y-v).P(x,y)\}}{\sum_{((x,y)\in P)}P(x,y)} \quad (5)$$

After successful determination of theta, rotation of palm print is done for vertical alignment using the affine transform. After vertical alignment the morphological operation is

performed to remove the holes and the palm print center is evaluated as follows

Figure 4: Center of palm calculation through distance transform

The distance transform which is evaluated as chessboard is shown as follows

$$\max[\|x1 - x2\|, \|y1 - y2\|] \qquad (6)$$

A fixed square region of 256 x 256 pixels is cropped around the calculated center of palm print.

2.5 Feature extraction and classification

Here an example is used for show feature extraction and verification in an understandable way, let us consider 10 palm print images of single user on which 5 images are used for training and remaining are used for validation. The obtained registered palm print image is analyzed

Figure 5: Three level decomposition of Palm Using Wavelet Transform

Here the results of Symlet have been found to be the best as compared to the other two wavelet types. Moreover the genuine acceptance rate of Symlet is also higher than the other two but still it does not satisfy the requirement of any acceptable biometric system. In the next stage, the performance of proposed algorithm is tested for multiple wavelets combination. Here GAR of 97.12 % was achieved. The decidability index was 2.9681 whereas the EER was 4.0702, Table 1. The results for wavelet combination are shown in Figure 16, 17 and 18. Thus by using the combination of multiple wavelets we have achieved significant improvement in the system performance. Fig 16 – Genuine and Imposter distribution for wavelets combination. Fig 17 – ROC curve for wavelets combination. Fig 18 – Threshold Vs FMR and FNMR for wavelets combination. 1. Speed The registration of an individual takes about 20.5 seconds whereas the identification takes about 22.5 seconds on a 1.5 GB RAM 1.67 GHz Intel Core Duo processor with Windows Vista operating system. The speed may be increased by using more advanced processors with real time operating system. Moreover, in the present scenario we believe that accuracy and precision are the main concerns over computational efficiency.

3. SIMULATION RESULTS

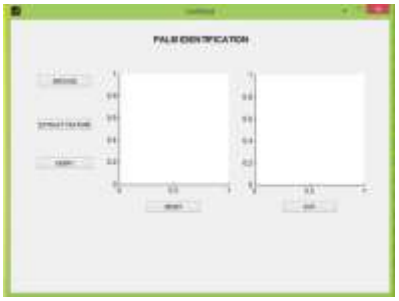

Figure 5: Initial palm print process

Analysis: Creating graphical user interface for the palm print authentication fort the privacy protection and its initial stage of the simulation result.

Figure 6: Initial palm print process by taking one image from the available database which is trained for the next latter step.

Analysis: Taking one image from the available database which is trained for the next latter step.

Figure 7: Initial and registered palm print images

Analysis: This image is obtained after training process and here registration palm print is available is show in next slot

Figure 8: Initial and registered palm print images with verification

Analysis: After successful registration if the matching process is completed then its same authenticate person or it says intruder

Figure 9: Initial and registered palm print images with verification and matching

Analysis: If the analysis is matched then the results will show the match is identified with certain person

Figure 10: Initial and registered palm print images with verification and matching (verified by palm)

Analysis: Finally after successful registration and training process completed at the final stage the verification is done

4. CONCLUSION

In the work we make use of palm print system for authentication and identification which works based advanced transform model namely wavelet transformation in different ways. The usage of different types of wavelets such as Biorthogonal, Symlet and Discrete Meyer are used for the accurate analysis and this task is carried out on around 500 images from 50 different users with minimum samples such as 10 samples on six month duration program. The experimental results obtained from the data have demonstrated the feasibility of the proposed system by exhibiting Genuine Acceptance Rate, GAR of 97.12%

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