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Application of Biometry for Bank Security System

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Abstract - Biometric identification is an emerging technology that can solve security problems in our networked society. ***A new approach for the personal identification using hand images is presented. This paper attempts to improve the performance of palm print based verification system by integrating hand geometry features. Unlike other bimodal biometric systems, the users do not have to undergo the inconvenience of using two different sensors since the palm print and hand geometry features can be acquired from the same image, using a digital camera, at the same time.*** **These features are then examined for their individual and combined performances. A new method of extracting palm print features is presented. Since palm print images have many creases which are organized like ridges, ordinary Fingerprint feature extraction algorithms are unable to extract ridges. Consequently, the goal of this paper is to construct a new feature extraction method which can extract ridges under these conditions. This technology actually processes on lines and points are extracted from palms for personal identification. This paper presents a novel biometric technique to automatic personal identification system using multispectral palm print technology.** ***The Palm print recognizes a person based on the principal lines, wrinkles and ridges on the surface of the palm. The recognition process consists of image acquisition, pre-processing, feature extraction, matching and result. The different techniques are used for the pre-processing, feature extraction, classifiers. Reliability and accuracy in personal identification system is a dominant concern to the security world. Biometric has gained much attention in this subject recently. Many types of personal identification systems have been developed, and palm print identification is one of the emerging technologies. Here actually, a 2-D Gabor filter is used to obtain texture information and two palm print images are compared in terms of their hamming distance. At first, the original palm print image is divided into local images. The ridge candidates are extracted from each local image of the palm print. Finally, only one candidate is selected as the ridge in the local image by estimating the continuity of certain properties.***

I. INTRODUCTION

PALM PRINT recognition uses the person‘s palm as a bio-metric for identifying or verifying who the person is. Palm print patterns are a very reliable biometric and re-quire minimum cooperation from the user for extraction. Palm print is distinctive, easily captured by low resolution de-vices as well as contains additional features such as principal lines, wrinkles and ridges. Therefore it is suitable for everyone and it does not require any personal information of the user. Palm print images are captured by acquisition module and are fed into recognition module for authentication. Basically Palm print has three modes: Enrollment, Identification and Verification. In personal authentication, Palm print employs either high resolution or low resolution images. The high resolution images refer to 500 dpi or more and suitable for forensic applications such as criminal detection while low resolution images refer to 100 dpi or less and suitable for civil, commercial applications such as access control. Palm print consists of principal lines, wrinkles and ridges. The principal lines are the major lines existing in most of people Palm print. The three main principal lines are heart line, headline and lifeline. Wrinkles and ridges are the coarse and fine lines of the Palm print respectively. The high resolution images can generally extract all the features while in low resolution only principal lines, wrinkles can be extracted. For real time applications low resolution images are used as they have less storage memory and fast matching speed. Palm print recognition consists of image acquisition in which image is capture with the help of device. Preprocessing sets up coordinate system to align Palm print images and to segment a part of Palm print image for feature extraction. Feature extraction obtains effective features. The matcher compares the extracted features with the features stored in the database. THE rapid growth in the use of many applications in different areas, such as public security, access control and surveillance, requires reliable and automatic personal identification for effective security control. Traditionally, passwords (knowledge-based security) and ID cards (token-based) have been used. However, security can be easily breached when a password is divulged or a card is stolen; further, simple words are easy to guess and difficult passwords may be hard to recall [1]. At present, applications of biometrics are rapidly increasing due to inconveniences in using traditional identification methods. Biometric technology may be defined as the automated use of physiological or behavioral characteristics to determine an individual’s identity [2].

II. PALM PRINT RECOGNITION

Palm print: In this thesis, we refer to that area of palm, also known as “lower palm” by some, having the principal or major lines. Human palm has line features including minutiae points just like in the case of fingerprints. Like fingerprints, a palm can be scanned to obtain an abundance of ridges and minutiae which form the finer details of the palm. Some vendor systems using these finer details for commercial use have been reported. These finer details are obtained by scanning the palm image at a high resolution of 100 DPI. In this thesis, we focus on the higher level textural information present on the palm in the form of major lines and small wrinkles. The reason for choosing to work with these is that the higher level details can be captured using a generic web camera at low resolution. The loss of accuracy on account

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of losing out on finer details is compensated by the gain in user convenience and no extra requirements of hardware. The accuracies obtained by using just the high level information is found to be sufficient for recognition of small groups of individuals (as shown by the literature survey in this section). The literature survey, hence, pertains to work done only on Palm print recognition using higher level texture details. Any Palm print recognition process has the following major steps:

Image Capture
Image Preprocessing
Feature extraction
Matching

The functionality of these has been described below:

A Image Capture

It is a very important step in the biometric template recognition as the quality of image captured has a great impact on the recognition accuracy. Initially, the palm images were obtained after scanning an inked palm. An inked image was able to capture all the major palm lines as well as the minor creases and wrinkles. Scanning it resulted in a high resolution image having distinctive signatures unique to people. Inked palm images can be used for forensic applications easily. However, the technique is not a good way of image capture for commercial applications. This led to creating dedicated scanners for Palm prints. These scanners need to be bigger than the traditional fingerprint scanners in accordance with the size of the palm. This was convenient for use in offline Palm print recognition. However, scanning a palm image takes a few seconds (because of its size) which makes it difficult to be used with an Online Palm print recognition system in real time. It is possible to capture the principal lines and a few major wrinkles in a palm image even at low resolution. One of the advantages of using Palm print as a biometric is that it can be used to distinguish people even with this low resolution image. This enables Online Palm print based identification in real time applications. David Zhang, introduced camera based palm print recognition using CCD cameras based on a special device for online Palm print acquisition. A stable Palm print image is obtained by using a case and a cover that is used to form a semi closed environment. A ring source provides uniform lighting conditions during Palm print image capturing. Also, six pegs on the platform serve as control points for the placement of the user's hands.

B. Image Preprocessing

The function of this stage is to segment out the hand image from the background and obtaining a binary image of the hand with known orientation and geometry. It consists of the following steps: Extracting hand from the background and Image Binarization, Determining the orientation of the hand, and detecting key points. Establishing a co-ordinate system Extraction of Region of Interest (ROI) i.e. palm. Extracting hand from the background and Image Binarization.

This step is similar in almost all preprocessing algorithms. The images obtained from the setup described in 2.1.1 have the following properties: The background is fixed. The distance between camera and the palm is fixed. Since the palm is placed on a platform having fixed pegs, there are no pose variations. Due to the artificial lighting present in the enclosing setup, the illumination is uniform and remains constant over sessions.

C. Palm Extraction

Once the co-ordinate axes are fixed, extracting the palm is relatively straight forward. The most common approach is to extract a square region of fixed size from a palm. As shown in, one of the way to extract a palm is to extract a square sub-image of fixed size taken at a fixed distance from the axis. But this can be a problem if the size of user palms varies greatly. If the fixed size is high, it might be too big for a small hand (for eg. a child's hand); if it is small, on the other hand, it may not be able to extract complete information from a user with a bigger hand and Poon et al. and Wang et al. proposed capturing variable sized palm so as to capture the maximum information from a user's hand. To extract features, Wang et al. proposed normalization of the palm image to a fixed size (scaling down).That way all the information in the palm could be imbibed even though on a smaller scale. Suggested, extracting a fixed length feature vector by dividing the variable sized palm into half elliptical rings of various radii as shown in the Figure. Each ring is then divided into equal number of regions and hence, getting a feature vector of uniform length.

D. Block Diagram and Description

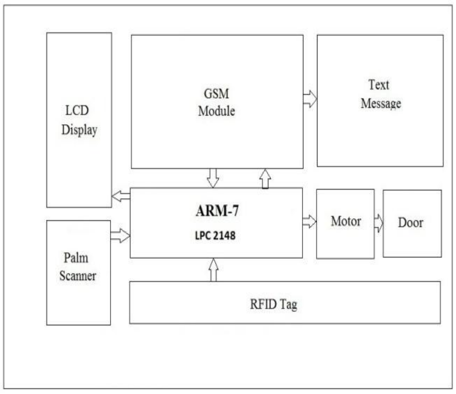

Fig 1 Block Diagram

1. COMPONENT DESCRIPTION:

1) ARM 7 processes the images and sends the signals to the input and output devices accordingly the results.

2) RFID module is capable of encoding information which consists of N address bits and 12N data bits.

3) GSM Module is used to message or to make call to the predefined number.

4) Palm scanner is used to scan the palm prints.

5) All these signals are given to the controller and then to the display.

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6) Motor gets signals from controller for the access of the door.

2.5 THE PARAMETERS TO BE MONITORED ARE

1. Liquid Crystal Display
2. Door
3. Motor
4. GSM Module
5. RFID Tag
6. PALM Scanner

E. Identification System

Fig. 2 illustrates the various modules of our proposed multispectral palm print identification (open set) system. The proposed system consists of preprocessing, feature extraction, matching and decision stages. To enroll into the system database, the user has to provide a set of training multispectral palm print images h Blue, Green, Red and Near-IR (NIR)i. Typically, a feature vector is extracted from each spectrum which describes certain characteristics of the palm print images using 1D log-Gabor filter. Finally, the feature vectors are stored as reference templates. For identification, the same feature vectors are extracted from the test palm print images and the hamming distance is computed using all of reference templates in the database. Based on this matching score (hamming distance), a decision about whether to accept or reject a user is made.

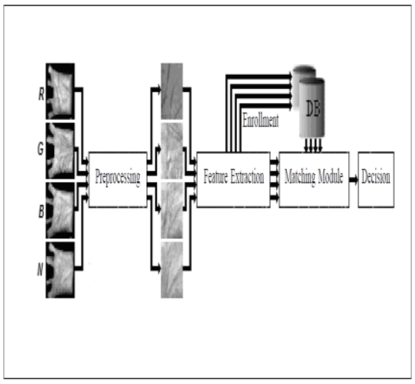

Fig 2 Block-Diagram Of The Multispectral Palm Print Identification System Based On The 1D Log-Gabor Phase Response

III. LOG-GABOR FEATURE EXTRACTION

A. The whole image of the palm print (each spectrum) is not really useful. Only some characteristics are needed. Therefore, each spectrum images may have variable size and orientation. Moreover, the region of not-interest may affect accurate processing and degrade the identification performance. Therefore, image preprocessing {Region Of Interest extraction (ROI)} is a crucial and necessary part before feature extraction. 1D log-Gabor filter is able to provide optimum conjoint representation of a signal in space and spatial frequency [6]. In our method, the features are generated from each spectrum sub-image (ROI) by filtering with 1D log-Gabor filter. Log-Gabor filters overview :

Gabor features are a common choice for texture analysis. They offer the best simultaneous localization of spatial and frequency information. One weakness of the Gabor is that the filter in which the even symmetric filter will have a DC component whenever the bandwidth is larger than one octave [7]. To overcome this disadvantage, a type of Gabor filter known as log-Gabor filter, which is Gaussian on a logarithmic scale, can be used to produce zero DC components for any bandwidth. The frequency response of a log-Gabor filter is given as:

$$G(f) = \exp \frac{[-i(\log(f=fo))2]}{[2(\log(¾=fo))2]}$$

…………………………….. (1) Where fo represents the center frequency, and ¾ gives the bandwidth of the filter. In the experiments, the parameters of log-Gabor filter were empirically selected as fo =1/2 and ¾ = 0.0556. are used in all calculation.

B. **Log-Gabor feature representation**

We utilize the response of 1D log-Gabor filter as a basic feature. At the features extraction stage the features are generated from the ROI sub-images by filtering each row image with 1D log-Gabor filter. The results (real and imaginary parts), ©r and ©i, are combined in the log-Gabor phase response, ª, as follows:

$$u_t(i,j) = \begin{cases} 1 & \text{if } \Psi(i,j) >= 0 \\ 0 & \text{if } \Psi(i,j) < 0 \end{cases}$$

……………………………. (2)

Phase information is extracted using Eq. (2) and then quantized to obtain the binary phase feature or template.

C. **Encoding process**

a. The log-Gabor phase response' ª' is qualitatively encoded as '1' or '0' based on the sign to obtain the template '.therefore, each point in the ª is coded to one bit by the following inequalities

$$u_t(i,j) = \begin{cases} 1 & \text{if } \Psi(i,j) >= 0 \\ 0 & \text{if } \Psi(i,j) < 0 \end{cases}$$

b. :

…………(3)

Proposed feature extraction technique is showing in Fig. 2.

2.6 FEATURE MATCHING

Each palm print spectrum is represented by a unique binary phase feature (Template). The matching between an input and a stored template consists of computing matching scores (degrees of similarity or dissimilarity)

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between them. The matching task in our experimental schemes based on a normalized hamming distance [8]. It is defined as the number of places where two vectors differ. we can define the Hamming distance Dh as:

$$D_h = \frac{1}{N^2} \sum_{i=1}^{N} \sum_{j=1}^{N} \psi_t(i,j) \oplus \psi_r(i,j)$$

………………… (4)

$\psi_t\ \psi_r$: The input and stored templates.

$\oplus$: The Boolean operator (XOR).

N*N : Size of the templates.

It is noted that Dh is between 1 and 0. For perfect matching, the matching score is zero. In order to further reduce the variation of the translation, all the sub-images (ROI) are translated by some pixels (-2, -1, 1, 2).

A. Fusion at Matching Score Level and Image Level

1. Fusion at matching scores level:

Fusion at the matching-score level is preferred in the field of biometrics because there is sufficient information content and it is easy to access and combine the matching scores [9]. In our system we adopted the combination approach, where the individual matching scores are combined to generate a single scalar score, which is then used to make the final decision. During the system design we have experimented four different fusion schemes: Sum-score, Min-score, Max-score, Mul-score and Sum-weighting-score [10]. Suppose that the quantity Dhi represents the score of the ith matcher (i = 1; 2; 3; 4) for different palm print spectrum (Blue, Green, Red and NIR) and F represents the fusion score. Therefore, F is given by:

Sum-Score (SUS):

$$F = \sum_{i=1}^{n} D_{h_i}$$

* MIn-Score (MIS): F = mini{ Dhig }

* MAx-Score (MAS): F = maxi{ Dhig}

* MUl-Score (MUS): $F = \prod_{i=1}^{n} D_{hi}$

* Sum-Weighting-Score (SWS):

$$F = \sum_{i=1}^{n} D_{h_i}$$

$$w_i = \frac{1 / \sum_{j=1}^{n} (1 / EER_j)}{EER_i}$$

……………………… (5)

Where wi denotes the weight associated with the matcher i,

with $\sum_{i=1}^{n}$ wi = 1, and EERi is the equal error rate of matcher i, respectively.

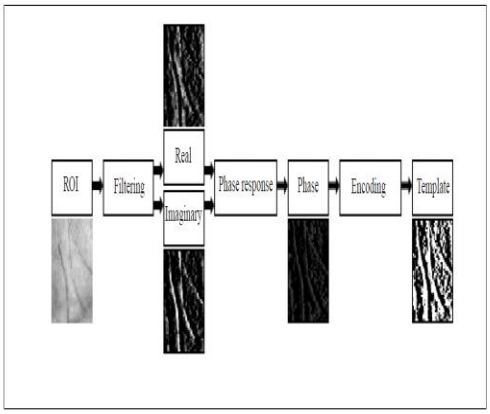

Fig. 3: Block-Diagram of the Proposed Feature Extraction Technique

B. Fusion at image level:

1) Image Fusion using DWT:

To enhance the performance of Palm print identification, two or more spectrum of palm print images are fused as shown in Fig. 3 (for Blue, Green and Red). Single level DWT is applied on these images to obtain the detail and approximation wavelet bands for these images. Let LLb, LHb, HLb and HHb be the four bands from all the spectrum Palm print images (b ´ Blue, Green or Red). To preserve the information from all the images, coefficients from approximation band and the three detailed bands of all images are averaged, as follow: Bf = mean(Bblue;Bgreen;Bred) (6) Where B represent one of the four band (B´ LL, LH, HL or HH), and Bf represent the averaged band. Inverse DWT is then applied on the four fused bands to generate the fused image. The result image is used for identification.

2) Image Fusion by RGB to YUV transforms (RGB-Y): Another representation of color images, YUV representation, describes luminance and chrominance components of an image (investigate the correlation between different spectrums to remove the redundant information of multispectral images [11]). The luminance component provides a gray-scale version of the image, while two chrominance components give additional information that converts the gray-scale image to a color image. The exact transformation from RGB to YUV representation is given by the following equations:

Y = 0:299R + 0:587G + 0:114B
U = ¡0:147R ¡ 0:289G + 0:436B
V = 0:615R ¡ 0:515G ¡ 0:100B
(7)

Where Y is the luminance component, and U and V are two chrominance components. The complete description of a color image is given by Y (Luminance component), for that, the component Y is used for identification.

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B.Performance of Image Fusion Algorithm

Image fusion is the process by which two or more images are combined into a single image. The goal of this section was to investigate the system performance when we fuse information from all spectrums of a Palm print images. In fact, at such a case the system works as a kind of multimodal system with a single biometric trait but multiple units. Therefore, information presented by different spectrums is fused to make the system efficient. For that, a series of experiments were carried out using the multispectral palm print database to selection the best combination (*RGB*, *RGBN*, *YN*, *RGB-Y*) and fusion technique (*YUV*, *DWT*) that maximize the *GAR*. Thus, to determine the best combination and their fusion technique, the numbers of training and test samples are 495 and 1485. We matched all the 1485 spectrum images (test) with each other to obtain 123255 distances. Thus, we have a total of 1485 genuine matching's and the remaining, 121770, impostor matching. A graphical relationship (ROC curves) can be established (see Fig. 6.(a)). The absence for the RGB with DWT fusion technique (RGBDWT) in the ROC curves can explain with the zero EER (EER =0%). Thus, the results suggest that RGB-DWT has performed better than other. For the reminder combinations, if the RGB-Y or RGBN-DWT combination is used, our identification system can achieve a FAR = 0.000 % and FRR = 0.076 % with a GAR = 99.999 % at the threshold To = 0.380. In the case of using the YN-DWT, FAR = 0.000 % and FRR = 0.125 % with a GAR equal to 99.998 % at the threshold to = 0.345. Finally, Fig. 6.(b) and Fig. 6.(c) show the genuine and impostor distribution for RGB-DWT combination and the FARFRR depending on the threshold. Thus, the developed system is expected to give higher accuracy. The system was tested with different thresholds, combinations and fusion techniques and the results.

C.Palm Print Image Acquisition and Preprocessing

Palm print image acquisition has two methods. The offline and online methods are used. In offline the palm is painted with ink and put it on paper then it is scanned. This collection method is very slow, it is not suitable for real time applications. Hence online method is used. In online method CCD-based Palm print scanners are used. These digital scanners [1,2] capture high quality Palm print images and align palms accurately because the scanners have pegs for guiding the placement of hands. This acquired image is further sent for the preprocessing. The preprocessing is used to segment the Centre for feature extraction and set up a coordinate system. Pre-processing [1] consists of five steps, 1) binaries the images, 2) boundary extraction, 3) detecting the key points, 4) establish a coordination system and 5) extracting the central part. The image is binarized by Otsu's [3] thresholding method. The algorithms used for the binarizing and boundary extraction are same but detecting key points [3,15] have tangent based [1], bisector based [16] approaches.

Zhong et al. [30] proposed the Palm print image adaptive threshold algorithm, boundary tracking and automatic positioning palm ROI by Euclidean distance, which guarantee the accuracy and efficiency of the identification systems. This approach has three advantages: (1) the algorithm is not complicated, (2) Accurate positioning which can reduce the impact of translation and rotation, (3) high noise endurance, good robustness. After establishing co- dimension by time and make feature matching beyond implementation. So Zhiqiang et al. [27] proposes a novel Gabor feature-based two-directional two-dimensional linear discriminant analysis GB(2D)2LDA for Palm print recognition. In GB(2D)2LDA, Gabor feature vector is derived from a Gabor filter bank, then (2D)2LDA uses the augmented Gabor feature vector as an input. Meanwhile, GB(2D)2LDA can reduce the augmented Gabor feature vector in horizontal and vertical directions sequentially, and hence fewer coefficients are required for image representation and recognition. Hence the GB(2D)2LDA is effective in both recognition accuracy and speed. As Gabor filter based texture information extraction method is both time and memory intensive to convolve palm images with a bank of filters to extract features. In the paper, by Meiruetal, [31] a novel Palm print texture representation is proposed, discriminative local binary patterns statistic (DLBPS) which is extracted for Palm print recognition. In this approach, a Palm print is firstly divided into non-overlapping and equal-sized regions, which are then labeled into Local Binary Patterns (LBP) independently. By calculating these patterns distribution, the statistic features of the Palm print texture are attained. Subsequently, the Discriminative Common Vectors (DCV) algorithm [31] is applied for dimensionality reduction of the feature space and solution of the optional discriminative common vectors. Finally, Euclidean distance and the nearest neighbor classifier are used for Palm print classification. You et al. [24] introduced a texture-based dynamic selection scheme facilitating the fast search for the best matching of the sample in the database in a hierarchical fashion. The global texture energy, which is characterized with high convergence of inner-palm similarities and good dispersion of inter-palm discrimination, is used to guide the dynamic selection of a small set of similar candidates from the database at coarse level for further processing. An interesting point based image matching is performed on the selected similar patterns at fine level for the final confirmation. Furthermore only the palm lines as feature are extracted using the edge detector. Wong et al. [25] applied the different Sobel operators to the resized Palm print image. The Sobel image is thresholded and represented using feature vector. The feature vector is in logical format that has the value of zero or one. All of the feature vectors are compared using Hamming distance similarity. An accuracy of 94.84 percent can be achieved using the proposed method.

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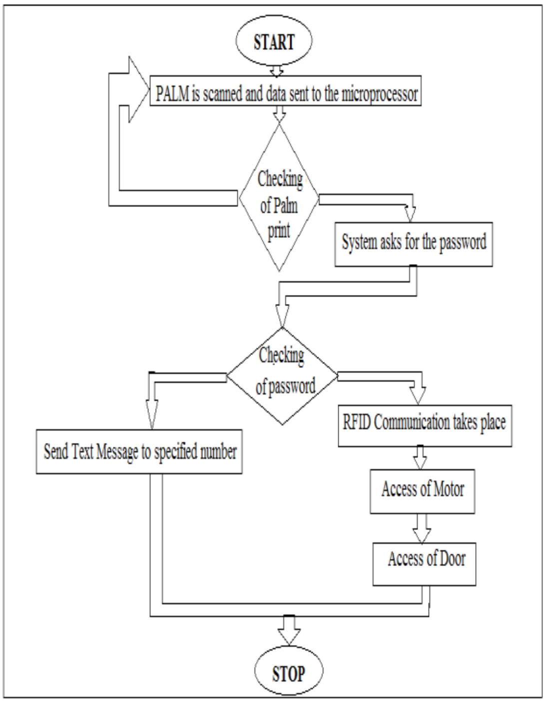
IV. SYSTEM

A. ALGORITHM

1. Start
2. Palm scanner will scan the user's Palm and sends it to the microprocessor.
3. The system will ask the password.
4. The RFID tag will be used to communicate.
5. Microprocessor will check the password and process the data.
6. If it is found to be correct then door will be accessed via motor through the microprocessor.
7. If the data is found to be incorrect then door won't be accessed and a text message will go to the number specified.
8. Stop.

B.FLOW CHART



C. Advantages

- The system can give real time response in accordance to the input provided.
- As the actual palm scanner is nearly impractical to implement so the system uses web camera as the input device for Palm scanning.
- Easy data processing or logging.
- The system is time saving as well as reducing the human efforts.
- All the features of the ARM Processors are achieved as the ARM Processor is used.
- Lower power consumption.
- The system is easy to install.
- The system gives a precise and accurate output.
- The system is highly reliable.
- The system is in affected by environmental conditions.

D. Applications

- In ATM Machines.
- In Colleges and Schools.
- Human-computer interaction, (i.e. gesture recognition, eye gaze tracking for data input to computers, etc. ;).
- In Hospitals and Library.

V. RESULT

The bank security can be done by the application by this concept. The ARM processor is interfaced with the Web camera as a Palm scanner, as well as the Motor which is used to operate the door. The text message goes to the number which is to feed in the database of the system. The RFID tag with the transmitter and receiver is also interfaces with the processor.

VI. FUTURE SCOPE

The system is used for security purpose of the bank. This same technology can be used to make the ATM transactions without the ATM card. That is the Palm can be used for withdrawing money from account, or changing the PIN of the account, etc. As there is no high power device is used, the system can be implemented at the environmental conditions where the electricity is not used or negligibly used. So at these situations, the system may become highly efficient and highly reliable.

VII. CONCLUSION

Palm print recognition has considerable potential as a personal identification technique as it shares most of the discriminative features with fingerprints and in addition possesses a much larger skin area and other discriminative features such as principal lines, ridges and wrinkles. An attempt is made to design algorithms to extract maximum features from low resolution with high accuracy. Coding based techniques have proven to be efficient in terms of memory requirement and matching speed. Researchers have also tried to fuse features like appearance-based, line and texture features from palm-prints, which has led to an increase in accuracy. Pixel-to-area based matching techniques are much more fault tolerant as compared to traditional pixel-to-pixel based matching techniques. The properties like multi-scaling, time-frequency local-ization, high degree of directionality and anisotropy are very useful in the Palm print verification. Using multi resolution schemes the finer local feature details can be extracted. Nowadays multi-scale, multi-resolution based techniques like wave-lets and contourlets are being explored as potential candidates for efficient implementation of palm print recognition.

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