Palm Vein Biometric Technology: An Approach to Upgrade Security in ATM Transactions

B. V. Prasanthi
Department of CSE
Vishnu Institute of Technology
Bhimavaram, India

S Mahaboob Hussain
Department of CSE
Vishnu Institute of Technology
Bhimavaram, India

Prathyusha Kanakam
Department of CSE
Vishnu Institute of Technology
Bhimavaram, India

A. S. N. Chakravarthy, Ph.D.
Department of CSE
UCEV, JNTU Kakinada
Vizianagaram

ABSTRACT

Technology advances day by day, the growth of malpractice in electronic transactions has also been increasing. Many hacking techniques for traditional passwords had come to authorize an unauthorized person while performing ATM transactions. One of the security mechanism to erase such fraudulent activities (in which an unauthorized person is performing transactions as an authorized one) is to identify and authenticate a user with their biometrics i.e., with their physical or behavioral characteristics as fingerprint, iris, palm vein, etc. This paper proposes an enhanced ATM system which provides security using palm vein technology with a unique identification number of an individual unlike traditional passwords.

General Terms

Digital Forensics; Biometric securities and authentication; Pattern Matching Algorithm

Keywords

ATM; Palm vein Technology; Authentication; Feature Extraction

1. INTRODUCTION

An Automated Teller Machine (ATM) is an electronic information transfer's gadget that allows the users of a monetary organization to perform their transactions without any prerequisite of human clerk, assistant or bank employee. On most of the modern ATMs, the client is known by inserting a plastic ATM card with a magnetic stripe or a plastic smart card with a chip that contains a novel card number. A personal identification number (PIN) is given to the user for the sake of their authentication, yet at the same time burglaries are happening [1]. This paper constitutes biometric authentication (palm vein technology) by linking it to Unique Identification Number (UIN) to provide more security and authentication.

The Unique Identification Authority of India (UIAI) is an agency of the Government of India responsible for implementing a novel ID task based on the Unique Identification Number scheme, to identify individuals, was established in February 2009.

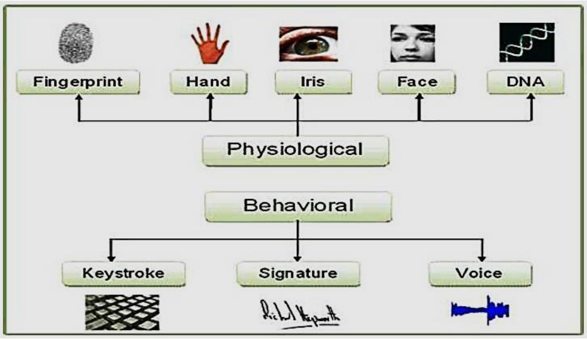

Fig 1: Categorization of biometrics

It is the process of authentication where the UIN number, along with other attributes (demographic/biometrics/OTP) is submitted to UIDAI's Central Identities Data Repository (CIDR) for a check; the CIDR confirms whether the information submitted matches the information accessible in CIDR and reacts with a “yes/no”. No personal identity information is returned as part of the response. The purpose of authentication is to enable residents to prove their identity and for service providers to confirm that the residents are ‘who they say they are' in order to supply services and offer access to benefits. Biometrics is the study identifying an individual based on their physical or behavioral characteristics.

Fig 1 shows various categories of biometrics [2]. Physiological characteristics which are identified with the state of the body which includes fingerprint, face recognition, DNA, palm vein, hand geometry, iris recognition (which has largely replaced retina). Behavioral characteristics are identified with the conduct of an individual, including typing rhythm (the frequency of typing), gait, digital signature and voice. Biometrics furnish a security combined with convenience, True authentication, accelerating and facilitating access, cost and workflow reduction. More traditional means of access control include token-based identification systems, such as driver’s license or passport, and knowledge-based identification systems, such as passwords or Personal Identification Number (PIN).

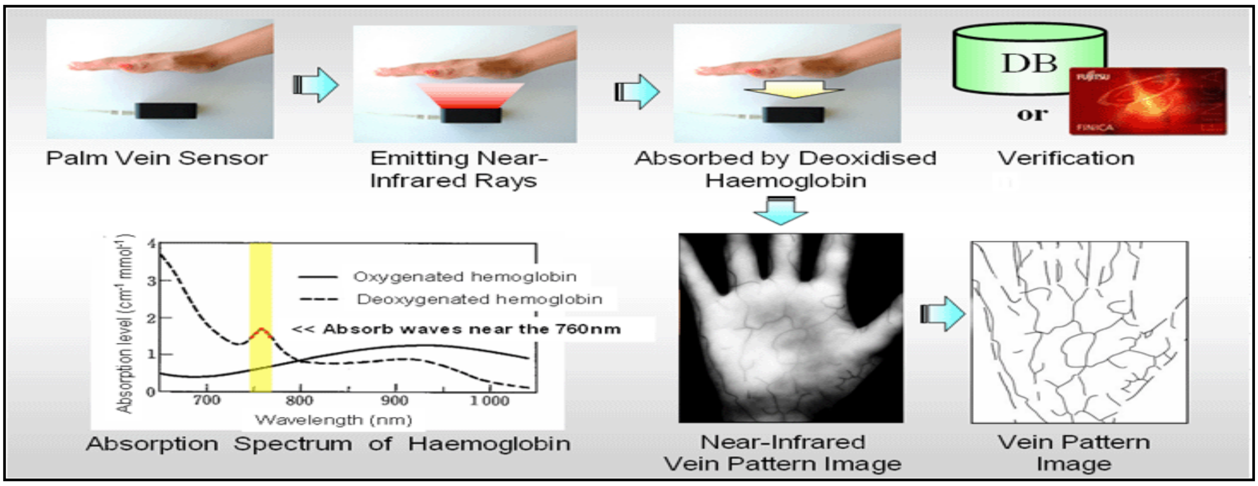
Palm Vein Sensor
Emitting Near-Infrared Rays
Absorbed by Deoxidised Haemoglobin
DB
or
Verification
Absorption level (cm⁻¹ mmol⁻¹)
Oxygenated hemoglobin
Deoxygenated hemoglobin
<< Absorb waves near the 760nm
700
800
900
1 000
Wavelength (nm)
Absorption Spectrum of Haemoglobin
Near-Infrared Vein Pattern Image
Vein Pattern Image

Fig 2: Palm Vein Technology

In the ubiquitous network society, where individuals can easily access their information anytime and anywhere, people are confronted with the hazard that others can easily access the same information. On account of this danger, personal identification technology is used which includes Passwords, Personal Identification Numbers and Identification Cards. However, cards can be stolen and passwords and numbers can be can be speculated or overlooked. To comprehend this, multi biometric methods can be used for authentication [3, 4, 5]. Of the entire Palm vein Technology is more secure to authenticate an individual will be discussed in section 3 and the later on sections contains its methodology and applications in various fields. Finally, we concluded in section 6.

2. PALM VEIN TECHNOLOGY

Palm vein technologies [6] are one of the promising new advances which are profoundly secure. It is the world’s first contactless individual ID framework that uses the vein patterns in human palms to affirm an individual's identity. It is exceptionally secure on the grounds as it utilizes data contained inside the body and is more accurate because the pattern of veins in the palm is unpredictable and novel to each individual [7]. Besides, its contact less features provide for it a hygienic point of interest over other biometric verification advances.

The above fig 2 illustrates palm secure works by capturing an individual's vein pattern image while radiating it with near-infrared rays. The Palm Secure identifies the structure of the pattern of veins on the palm of the human hand with the at most precision. The sensor radiates a near-infrared beam towards the palm of the hand and the blood flowing through these back to the heart with reduced oxygen absorbs this radiation, causing the veins to appear as a black pattern. This pattern is recorded by the sensor and is stored in encrypted form in a database, on a token or on a smart card.

3. METHODOLOGY

Initially bankers will gather the client's UIN numbers and palm vein samples with the assistance of palm vein scanner at the time of opening the accounts. Retrieved palm vein images are normalized and some features can be concentrated among them, which is put away as enrolled information in a database. The entire procedure is presented in terms of flow chart as shown in fig 3.

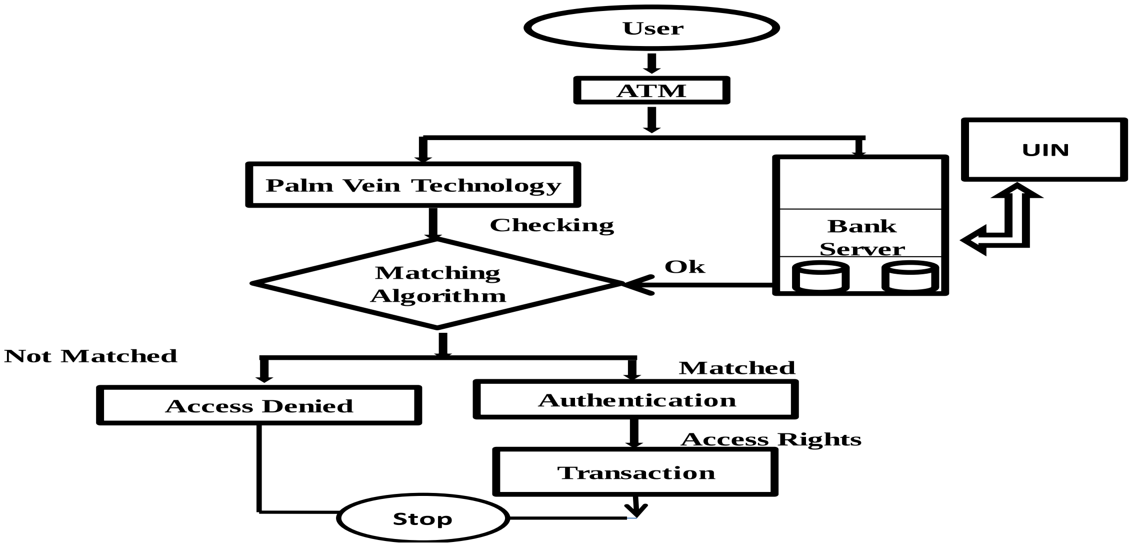

Fig 3: Flowchart of proposed ATM

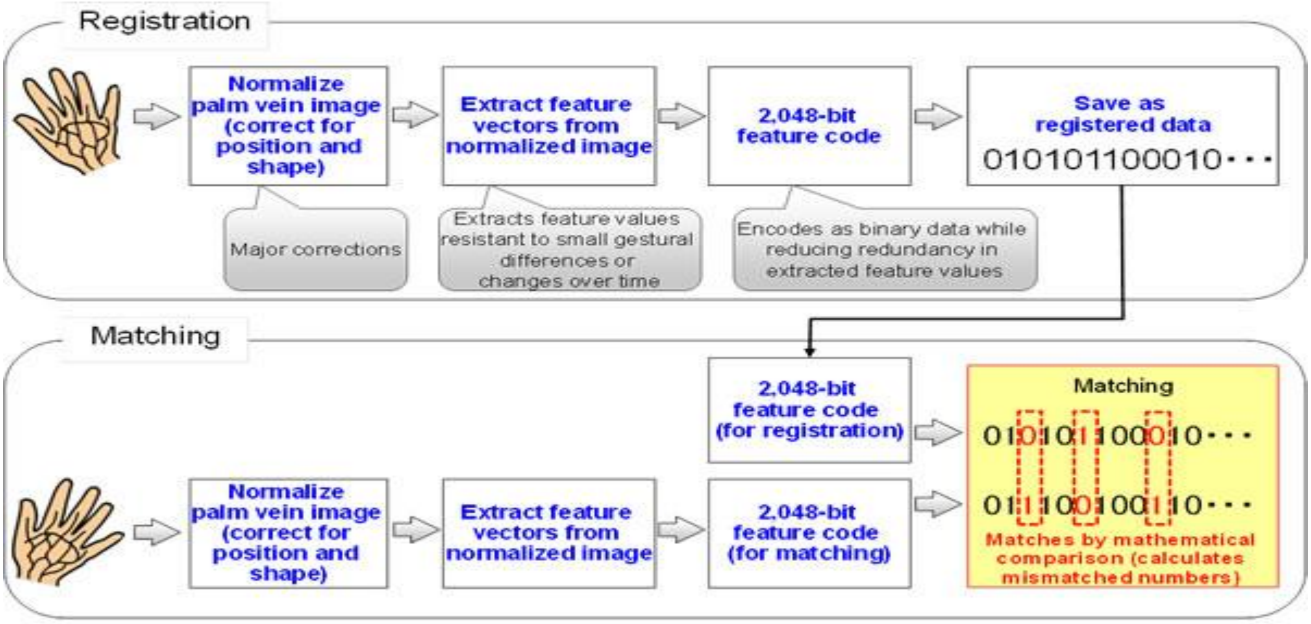
Registration
Normalize palm vein image (correct for position and shape)
Extract feature vectors from normalized image
2,048-bit feature code
Save as registered data
010101100010・・・
Major corrections
Extracts feature values resistant to small gestural differences or changes over time
Encodes as binary data while reducing redundancy in extracted feature values
Matching
2,048-bit feature code (for registration)
Matching
010101100010・・・
011100100110・・・
Matches by mathematical comparison (calculates mismatched numbers)
Normalize palm vein image (correct for position and shape)
Extract feature vectors from normalized image
2,048-bit feature code (for matching)

Fig 4: Enrollment of Palm Vein Samples

While accessing their transactions the client places their palm on the individual scanner which is appended to the machine and the captured samples of users are compared with their enlisted information [8, 9]. If any match founds, as it is linked to the CDIR repository, it once again checks whether they are an authorized one or not. If both match, the user was given an access rights to perform transactions. In this mechanism, there is no need of remembering passwords; our hand is a key to perform the transaction. Here, the authentication happens at two levels; at first, at the time of verification at the ATM machine our palm vein will be contrasted and that of the sample given at the time of enrollment and secondly, UIN number related to that sample is compared with that of UIN in CDIR archive. Thus the palm vein technology provides a two-way authentication along with the UIN number. Basically, there are two steps as shown in fig 4 while dealing with biometrics to perform the transactions: Registration and Matching.

3.1 Registration

During the acquisition of the palm vein pattern, various mathematical operations are applied to the information in order to digitize that image which are captured by using Near Infrared Cameras later it is continued by pre-processing in which aims at the improvement of the image information that suppress unsought distortions or enhances some image options important for further processing. Noise reduction is the method of removing noise from a signal. The first step in image pre-processing is image cropping. Some immaterial parts of the image can be removed and therefore image region of interest is concentrated. Thinning is a morphological operation that is used to remove selected foreground pixels from binary images, somewhat like erosion or opening. When the input data is too large to process for an algorithm and it is suspected to be notoriously redundant (much data, but not much information) then the input data will be transformed into a reduced representation set of features (also named feature vector). This step is called feature extraction. Then the input data are ready to perform specific tasks in its transformed way.

3.2 Matching

Template matching [10] is a technique in digital image processing for finding small parts of an image which match a template image. Template matching can be subdivided into two approaches: feature-based and template-based matching. The feature-based approach uses the features of the search and template image, such as edges or corners, as the primary match-measuring metrics to find the best matching location of the template in the source image. The template-based, or global, approach uses the entire template, with generally a sum-comparing metric (using SAD, SSD, cross-correlation, etc.) that determines the best location by testing all or a sample of the viable test locations within the search image that the template image may match. Pattern matching [11] is a method of identifying features in an image that match a smaller template image (that is, the "pattern" to be matched). The process involves two phases: an off-line learning phase in which the template is processed, and a matching phase that can be executed in real time.

3.3 Accuracy

It is also highly accurate in testing using 1,40,000 palm profiles of 70,000 individuals in Japan; it had a false acceptance rate of less than 0.00008% and a false rejection rate of 0.01% as presented in table 1.

Table I : Comparison of various biometrics

Technology	FAR	FRR
Palm Secure	0.00008%	0.01%
Fingerprint	1-2%	3%
Iris	0.0001%-0.94%	0.99%-0.2%
Voice	2%	10%

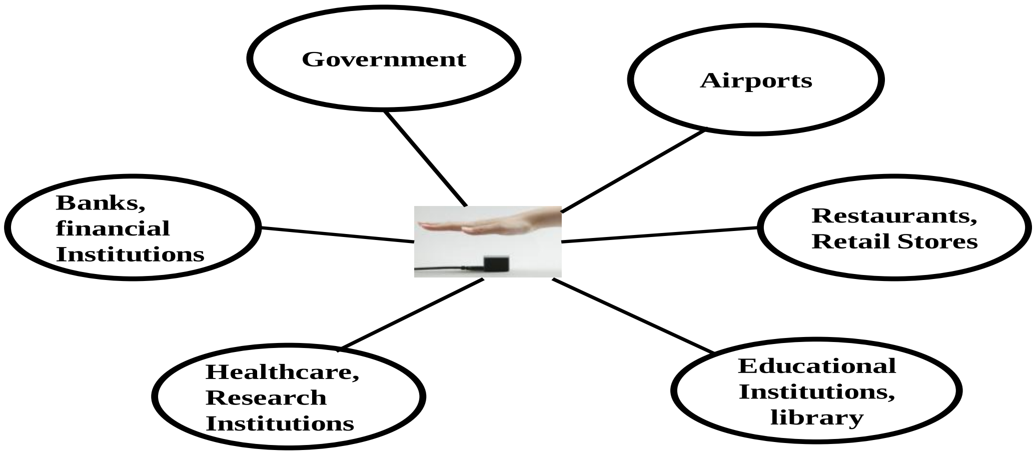
Government
Airports
Banks, financial Institutions
Restaurants, Retail Stores
Healthcare, Research Institutions
Educational Institutions, library

Fig 5: Applications of palm vein in various sectors

3.3.1 *False acceptance rate (FAR)*

FAR measures how frequently unauthorized persons are accepted by the system due to erroneous matching or A rate at which someone, other than the actual person is falsely recognized.

3.3.2 *False rejection rate (FRR)*

FRR is probability that the system fails to detect a match between the input pattern and a matching template in the database (or) the rate at which the actual person is not recognized accurately.

4. VARIOUS APPROACHES/ MODELS

There is a great deal of detriments while considering distinctive sorts of biometrics with ATM to provide security. Anybody holding the card with PIN number known can operate and no need to be the original owner of the card. At the point when ATM card is combined with Fingerprint, then it may not be relevant to every person. The issue may cause while catching the finger impression with messy or harmed fingers [12, 13]. There ought to be incessant cleaning of sensor, which is dealt with at a lower security level due to image transfer and external body feature. When we access the ATM card with samples of Iris, then it is inconvenient for users who are having glasses and contact lenses. It is exceptionally hard to position eyes effectively as the height of users may vary. When ATM Card is joined with extracted features of the face for authentication, then it is very easy to forge and if any change happens to the face such as make up, beard hair, etc., the system will not work properly.

On the off chance that ATM is utilized with the assistance of one-time password, then in this system the User embeds the card and enters his pin, then in the interim, he/she gets OTP to his versatility, which to be again entered in the framework to perform an exchange. Because of the climatic change or no flag, the getting of OTP may postpone which is an impediment. On the off chance that any of the above multimodal Biometrics techniques [14] are contemplated for client verification. It additionally causes hazard and time taking.

5. ADVANTAGES OVER PALM VEIN TECHNOLOGY WITH UIN

It is ideal enrollment and the biometric feature is inside the body. It can be utilized as contactless identification procedure, and there is no need of sensor cleaning. It even works with harmed or grimy hands. It is very nearly difficult to forge & duplicate. It Protect sensitive financial information and Reduces loss because of wholesale fraud. The applications [15] in various sectors shown in fig 5 are as follows,

- By implementing this technology in any organization, it is easy to monitor and maintain entry and exit timings of every employ.
- It is used for visitor verification in Airports
- It is used in the healthcare & research Institutions to maintain ID verification for medical equipment, electronic record management for patients.
- It is used for customer data management in Banks & Financial Institutions
- Federal Railroad Administration (FRA)has developed Biometric based Locomotive Security System (LSS)to prevent unauthorized use of Locomotives.

6. CONCLUSION

This palm vein technology and UIN card mechanism has a biometric live to boost the safety options of the ATM for effective banking dealing for banks. The paradigm of the developed application has been found promising on the account of its sensitivity to the popularity of the customers‟ palm vein samples & UIN card recognition as contained within the information. This technique once absolutely deployed will certainly cut back the speed of deceitful activities on the ATM machines such solely the registered owner of a card access to the checking account. Associate embedded palm vein biometric identification theme for ATM banking systems is planned in conjunction with UIN authentication for a lot of security; additionally enclosed during this paper. Finally, conclusions square measure drawn out when perceptive the UIN& Palm vein Authentication theme results.

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