

Multimodal Biometric endorsement for secure Internet banking using Skin Spectroscopy, Knuckles texture and Finger nail recognition

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Abstract - Biometric is verification by analyzing the unique biological qualities which a person can differentiate from another. Data that collected by some of these technologies distinguish a single individual from the entire global population. The most secure banking now is the use of token based authentication. The two main reasons are that one person cannot use the biometric samples of another person and each time in token based method you want to type a new number this can be avoided in this biometric system. This paper proposes to implement the multimodal biometric authentication for Internet Banking by combining the skin texture, knuckles and nail plate by cryptography techniques. Instead of using the Unimodal biometric here we used the Multimodal biometric system. The limitation in the older techniques leads to new techniques by using the, Skin spectroscopy, Finger Knuckles Surface and Nail plate Surface. Skin spectroscopy has different optical properties. In sensor a small patch of skin texture is taken and passes through the infrared light in a multiple wavelength. The various skin spectroscopy is ideally suited to layering in dual biometric system, helping to build high performance. The skin patterns are identified by algorithms using the skin texture analysis or spectral analysis is physical trait that is through to be distinguishing among all people including identical twins. Second one is using Finger Back Knuckles surface (FBKS) which is a new approach for personal recognition based on geometric analysis and texture analysis by considering both proximal, phalanx, distal phalanx. The extracted shape oriented and texture features information is integrated to yield better accuracy results and makes it highly suitable for large scale personal authentication system. Third one is using the finger nail plate surface as a distinctive and unique attribute for personal authentication. In nail plate surface authentication technology the ridge pattern which is present on the nail is very highly unique in case of individual and also in case of twins and also even in different fingers of hand. Developing and under developed countries are also taking the lead from developed countries and deploying multimodal biometric systems. Finally the multimodal system along with cryptographic approach shows the better performance accuracy for this automatic identification and authentication in Internet Banking.

Key Words: Cryptography, Skin Spectroscopy, Finger Back Knuckles surface (FBKS), finger nail plate surface.

1. INTRODUCTION

Banking is one of the most vital sectors that used for transaction as well as online Transaction. Now all the Banks are globalized and they used the concept of Information technology. Any unauthorized or illegal transaction takes place by the hackers then it affects all the globalized organization. But nowadays the technology gives a great opportunity to satisfy the banking transaction in an efficient way. Banking Sector is not only for the business peoples it is used by all types of peoples it is not only a business to business it is business to Customer. According to Michael Higgins, a financial computer security consultant of Para-Protect in Alexandria, Virginia, banks usually want to avoid bad publicity by reporting losses as accounting efficiency errors. Intrusion can be taken place at any level. so, if a system is affected by any of security issues (i.e.) Without the knowledge of the Owner the confidential data or money is steal or the value is changed by an unauthorized person. It affects the financial Organization. These types of intrusion not only affect the system performance but also the client and customer trust towards the bank. To avoid this deadly situation in this paper we discuss about the Multimodal Biometric Authentication using Voice, Eyebrow and Palm recognition. By the end of 2015, there will be approximately 450 million bank customers using biometrics in various banking scenarios including withdrawing cash, from ATM, proving identity in telephone banking and authentication in their mobile bank app using fingerprints. "There is a growing desire from the banking industry to adopt convenient methods to verify the identity of their customers and this is creating the conditions to drive the adoption of biometrics in banking even higher," said Alan Goode, author of the report and founder of Goode Intelligence. "The adoption for banking purposes is a major contributor to this growth and we are forecasting that by 2020 it will contribute US\$5.5 billion in revenue for companies involved in delivering biometric systems to the banking industry." The report also highlights major trends shaping the industry, including the rise of multi-modal mobile-based biometric authentication, tighter integration with fraud detection and fraud management solutions including adoption of behavioural biometrics/analytics, and different speeds of adoption and regional differences.

1.1 Biometric Evolution and Predominance in Internet Banking

Biometric is verification by analyzing the unique biological qualities which person can differentiate from another. Data that collected by some of these technologies distinguish a single individual from the entire global population. Biometrics in banking has progress over the decades, and it has attained some level of maturity. Until 2005 financial services world used finger prints, signature recognition, vein pattern and hand geometry, and after 2005 the technology extended to voice biometrics, Iris Scan, face recognition. In Japanese bank have the high level of maturity by offering their customer bank cards with a chip that carries biometric data.

1.1.1 Why Biometrics

“Kill the password dead as a primary security measure” said Michael Daniel, cyber security coordinator for the president. Data security is not simply a matter of encryption, secure networks, long passwords and firewalls. Time and again insider negligence or malicious conduct is the leading cause of data breaches. Biometrics is seen as the future of the data security. The passwords can be easily stolen by the hacker but the biometric data can't be stolen or misuse. There have been many developments in the field of biometrics which means things are more reliable and costs are down. Biometrics offer high level identification management security operations that have several advantages over traditional means now they are available at low cost. Many Business owners are adopting biometric identification management system to save one time resource and to increase security.

1.1.2 Biometric Techniques:

In biometrics traditionally they used these methods such as, facial recognition, Iris, finger Print, finger vein, lips and voice. But now, the technology evolves and the new emerging biometric techniques boom for check the data authentication.

They are 1. Human scent recognition 2. EEG biometric 3. Skin Spectroscopy 4. Knuckles texture 5. Finger Nail recognition. The limitations in the older techniques lead to the new techniques.

Table -1: Biometric Techniques with its Limitations

S.No	Biometric Techniques	Limitations
1.	Facial recognition	Affected by changes in lighting
2.	Voice recognition	Low accuracy. All illness such as cold can change the person voice, finding absolute identifiers difficult or impossible
3.	Signature recognition	Individuals don't have the consistent manner in signing have difficult and error rate rises.

4.	DNA	Very expensive
5.	Retinal Scanning	Very intrusive. People think it is harmful to eyes. It is very expensive.
6.	Iris recognition	Very expensive. Needs lot of memory to store the data.
7.	Hand geometry	Affect by dirty or age factors or any accident.

These limitation in the traditional biometric system such as facial recognition, Iris, finger print finger vein, lips and voice leads to the new emerging biometric system.

2. MULTIMODAL BIOMETRIC

The most secure banking now is the use of token based authentication. Token is generated as a special number which along with the password that we used to log in to your account. This is very hard to trace out by the hackers, but stealing the token device may happen.

The two main reason are that one person cannot use the biometric samples of another person and each time in token based method you want to type a new number this can be avoid.

Identifying a person is a critical issue in a various sectors like access control, communication, banking and electronic commerce etc., Knowledge based methods like passwords or token based methods like ATM cards, ID cards, pan cards can be stolen or it may missed in any situations or the pin number can be forgotten by us. Biometric is an identification that describes the person by his or her physical or behavioral characteristics. It verifies the user characteristics like face, finger, palm, iris, gait, signature, voice etc., for reliable authentication system. Unimodal biometric system uses a single modality of a person for identity verification. Claimant input identity is verified against stored template in the database. Biometric system performs in four levels of operation.

- First, Sensor level which captures the input data
- Second, Feature level which extract the salient features of the captured image.
- Third Score level which finds the match score by comparing it with the stored template in the database.
- Fourth, the decision level which helps in establishing the identity of the input image.

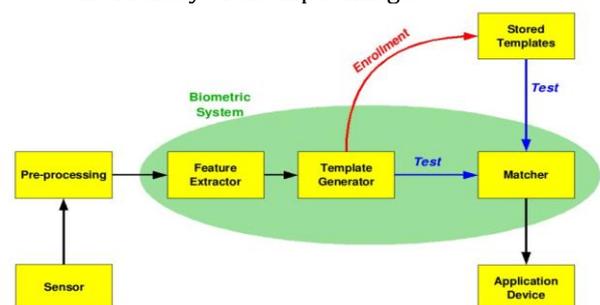


Fig -1: The four levels of operations

Unimodal biometric systems have various limitations such as noisy sensor data, spoof attack, interclass variations, Intra class variations etc. These drawbacks can be overcome by the Multimodal i.e. by using the multiple source of individual information and then establishing his or her identity by Multimodal biometric system.

2.1 Benefits of Multimodal Biometrics

The benefits of Multimodal biometrics is

- **Accurate identification:** Multimodal biometrics uses information from two or more biometrics – (e.g. fingerprint and finger vein pattern; or fingerprint and iris and voice) whereas unimodal biometric systems use information from one biometric – (e.g. fingerprint, iris, palm, signature, voice, hand shape, or face).
- **Accountability:** Biometric deployments that encompass large scale population databases are turning to multimodal systems.
- **Reliability:** A multimodal biometric system permits a greater level of assurance for an accurate match in verification as well as identification modes.
- **Security:** Another advantage of a multimodal biometric system is that by making use of multiple methods of identification, a system can preserve higher threshold recognition settings and a system administrator can make a decision on the level of security that is needed.
- **Vulnerability:** Spoofing is the biggest threat to authentication systems. Multimodal biometric system distinguish between a living and a fake sample and is generally done by measuring biometric features like humidity, pulse, blood flow, temperature, etc.

3. BIOMETRIC AUTHENTICATIONS

In this paper we discuss about using the Skin spectroscopy, Knuckles texture and finger nail recognition as multimodal biometric. Combining these biometric techniques make a banking transaction as a authentic one.

3.1 Skin Spectroscopy

Skin spectroscopy has different optical properties. In sensor a small patch of skin texture is taken and passes through the infrared light in a multiple wavelength. The light is reflected back after being scattered in the skin and is then measured for each of the wavelength. Reflectance variability of the various light frequencies as they pass through the skin are processed and analyzed to extract a characteristic optical pattern that is compared to the pattern ion record or stored in the device to provide an authentication. The optical signal is affected by changes to the chemistry and other properties of human skin it also provides a sensitive and relatively easy way to confirm that a sample in living tissue [3].

Non human tissue or synthetic material has different optical properties than living human skin. A

spectral biometric system consists of three major subsystems.

- 1) Optical sensor
- 2) Electronics to drive the sensor
- 3) The algorithm and procedure used to derive the biometric features from the raw spectral data.

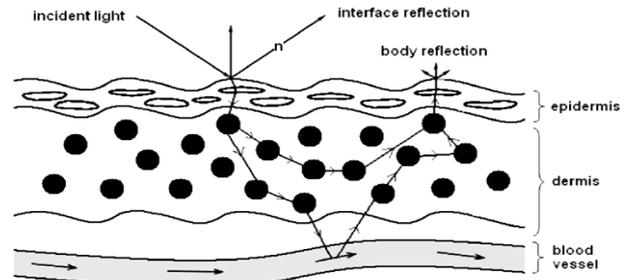


Fig -2: Skin Texture

The various skin spectroscopies are ideally suited for layering in dual biometric system, helping to build high performance. The skin patterns are identified by algorithms using the skin texture analysis or spectral analysis in physical trait that is to be distinguished among all people including identical twins. These techniques may be highly resistant to spoofing attack. Skin spectroscopy is unrestricted by physical, biological, cultural or religious hurdles. Initial design shows system sensor to be small, fast and durable. The low cost and low power consumption and the algorithms processing efficiency and low memory requirements make this technology promising for use portable device.

3.2 Knuckles Texture

Finger Back Knuckles surface (FBKS) is a new approach for personal recognition based on geometric analysis and texture analysis by considering both proximal, phalanx, distal phalanx. The usage of Finger_Knuckle images for personal identification has shown promising results and generated a lot of interest in biometrics [2] FKP can be also captured concurrently in order to improve their authentication performance without adding an extra device.

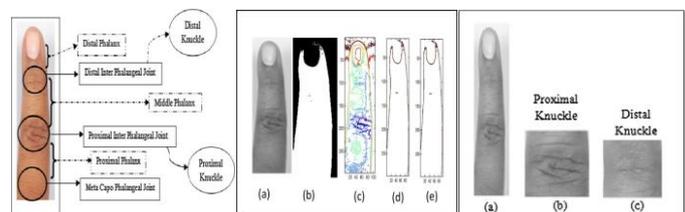


Fig -3: Finger Knuckles Images

The Proximal Phalanx refers to the major bend surface of a finger and is found in the middle portion of the finger back region whereas distal phalanx refers to minor bend surface found near to the tip of the finger back region.

The distal phalanx is smaller in size it has unique decimal pattern which when exploited along with proximal results in

highly improved performance in finger knuckle print recognition. The rich set of patterns generated by each of the finger knuckle surfaces with lines, contours and creases is highly unique for distinctive identification of individuals. It is highly acceptable by users. Multi resolution transform known as contourlet transform which effectively represents the cured singularities than the wavelets is highly suitable for represents finger back knuckles surface texture. The extracted shape oriented and texture features information is integrated to yield better accuracy results and makes it highly suitable for large sake personal authentication system.

3.3 Finger Nail Plate

Use the finger nail plate surface as a distinctive and unique attribute for personal authentication. In nail plate surface authentication technology the ridge pattern which is present in the nil is highly unique in case of individuals, twins and also even in different fingers of hand [7]. There has not been any attempt to utilizing texture and appearance based feature of nail plate for personal authentication it is a new and challenging characteristic of nail plate from hand and is emerging as a promising component of biometric. This system based in the outer surface of the finger nail. The nail plate is a new and promising biometric device for forensic and civilian and military application. The cross section if the nail in it consists of nail plate, nail matrix and the nail –bed that are tightly fused keratinized layer[8]. The nail bed consists of two types of tissues such as dermis and epidermis layers which is closest to nail plate surface and this layers are referred to as arched and valley portion of the nail and is forms a unique structure and closely parallel and irregularly space. These longitudinal striations which are presented on the nail plate surface are highly unique for every individual and serves as a means of personal authentication. Thus the individuality in the uniqueness of nail plate surface based biometrics is completely dependent on the intrinsic anatomic characteristic of the nail organ.

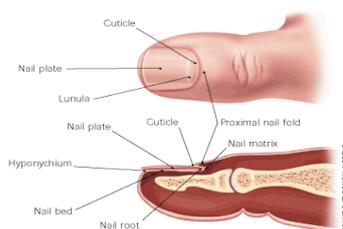


Fig -4: Nail Plate Images

The users has the freedom of placing the hand in any orientation, the acquired hand images present a lot of translational and rotational variations. To extract the exact region of interest of nail plate the pre processing steps is needed to acquire dorsal hand image [9].

Firstly, the each acquired dorsal hand image is subjected to binarization using a fixed threshold value and remove some noise is still present in image which subjected to morphological corrections which fills hole inside the

foreground and remove the background debris and result in the binary mask, which further used for finger localization and alignment, then to locate the key points in the hand i.e. tips and valley point for eliminate the some rotation and translation variation. The n global hand registration techniques used for normalize the hand and e orientation of the fingers and further used to extract the accurate region of interest. Then further decompose the finger drawing the binary line of zeros between two adjacent valley points. Further the nail plate surface segmentation approach presented to accurately segment the ROI with the grown nail plate or presence of nail polish on the female nail plate surfaces. This approach works at pixel level and classifying the each pixel into nail plate or non nail plate region.

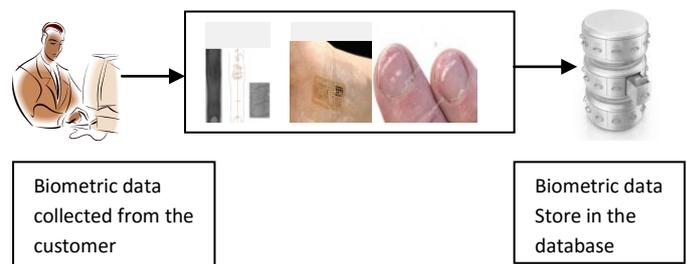


Fig -5: Biometric Sample data save in Database

According to Multimodal biometric implementation it is more secure because of combining three samples as a data for authentication. The three samples that collected from the customers of the bank are stored in the database. During the internet banking the transaction is more secure. The texture those taken from these three biometric techniques are stored as a image in the database. The samples are taken by applying the different methods and stored as a multimodal data in database. The data in the database can be prevented from the hacker by the means of using the cryptography techniques.

4. CONCLUSIONS

Based on the analysis, we have concluded that multimodal biometric systems have more advantages over unimodal biometric systems or traditional authentication systems. For an extremely high security, we have to use up to three biometric identifiers and for a lower security, you could possibly require one or two credentials. If one of the identifiers fails for any unknown reason, your system can still utilize another one or two of them in order to provide the accurate identification of a person. The hacker or any unauthorized person can't steal the samples and use it. In this paper we discussed the use of the emerging techniques such as skin spectroscopy, Knuckles texture and the nail plates which are the new trends in the biometric system. When compare to other biometric techniques these three are low cost and more effective with low limitations. The design of the multimodal biometric system must ensure that it does not threaten personal or informational privacy. Applying

visual cryptography techniques will maintain security in storing the data in the database.

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