A Comparative Study on ATM Security with Multimodal Biometric System

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Abstract--Security is a major issue in Automated Teller Machine (ATM).with the wide spread utilization of electronic transactions it is necessary to increase customers recognition accuracy. Biometric systems can offer convenient and secure mode of authentication to the customers. This paper proposes a survey of how multimodal biometric system enhances level of security in ATM system. Multimodal biometric system makes use of various biometric traits simultaneously to authenticate a person's identity. In multimodal biometric system authentication method can vary with according to the following parameters like architecture, fusion level, and methodology for multiple verifiers' integrations. In this paper a comparative study of the work done by various methods has been made in detail and an attempt has been taken to correlate and identified strengths and weakness of the existing methods for exploring the problem more in detail.

Keywords--Biometric authentication; multimodal biometric system; Automated teller machine; security

I. INTRODUCTION

In recent years, with the wide utilization of internet technology   it is necessary to raise ATM security. However, the internet communication will be exposed there by unwanted people allow to do different kinds of attacks on ATM System. Study of various attacks affected on ATM System are detailly described and is shown in Figure 1.

Some of the threats affected to the ATM are like:

- Eavesdropping
- Spoofing
- Skimming Attack
- Card Trapping
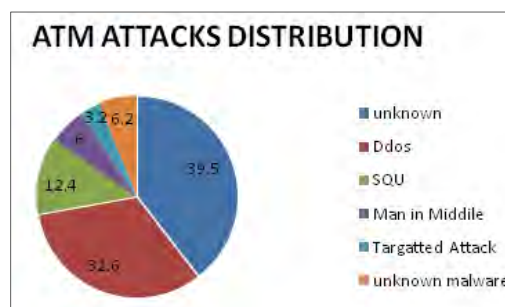- PIN Cracking
- Phishing Attack
- ATM Malware
- ATM hacking

Figure 1: Comparative survey of ATM attacks

Biometric authentication is the only solution to prevent attacks on ATM customers. Biometric systems uses person physical or behavioural characteristic to identify or verify individuals. In ATM centres users to authenticate themselves by entering UserID and biometric trait as a password. Biometric characteristics of an individual are unique and therefore can be used to authenticate a user's access to ATM centres.Initial cases authentication in ATM centres are done with Unimodal Biometric methodologies. But it can raise a variety of problems such as the lack of universality of some characteristic, the safety of the used sensors, the limitation of the discrimination of biometric systems due to a high in-class and low inter-class variability, the lack of

permanence and variability in time of the biometric characteristics, the fraud possibility through voluntarily or involuntarily cloning of a biometric characteristic, noisy data and unacceptable error rates. Limitations of Unimodal biometric systems can be overcome by using multimodal biometric systems. Some of the limitations of a biometric system can be addressed by using a consolidation of multiple sources of biometric information [1,2,3]. A multimodal biometric system combines a variety of biometric identifies in making a personal identification and takes the advantage of the capabilities of each individual biometric. Based on the nature of biometric modalities, multibiometric systems can be classified into six categories including multi-sensor, multi-algorithm, multi-instance, multisample, multimodal and hybrid [4].

A simple multimodal biometric system consists of four basic components:

1) Sensor module which acquires the biometric data

2) Feature extraction module where the acquired data is processed to extract feature

  vectors

3) Level of fusion where more no of vectors are integrated

3) Matching module where feature vectors are compared against those in the template

4) Decision-making module in which the user's identity is established or a claimed

  identity is accepted or rejected.

II.   RELATED WORK

Today's, genuine customer authentication in the banking and finance sector made it challenging task. With the wide invent of integrating biometric technology into the banking applications, customers are doing transactions effectively. In India the progress of using ATM with biometric technologies is almost very low. The other countries like US, UK, Japan have deployed wide range biometric technologies to their banking and finance applications. Now almost all Japanese banks ATM's are running with Palm vein recognition. In Tokyo Mitsubishi bank done customer's verification with biometric technology only.sumito banking corporation adopted palm vein technology to run their financial transactions. Bank of Columbian Bancafe launched ATM network scanning with finger print recognition. To enhance security levels of ATM some of the authors proposed multilevel of security over unimodal. An embedded fingerprint system proposed by Amurthy and Redddy [5] which is used for ATM security applications. These systems can enroll customers by collecting customers' finger prints and mobile numbers and then the customer access ATM machine with the success of verification process. An embedded Crypto-Biometric authentication scheme was developed by Debbarma [6] for ATM banking system.

III.   METHODOLOGY

In multimodal system users are allow to give the combination of various physiological /behavioural characteristics for their identity. The following steps are used to describe how person recognition is done with multimodal biometric system which is show in Figure 2 .

Steps in multimodal biometric systems

- Image Acquisition
- Preprocessing
- Feature Extraction
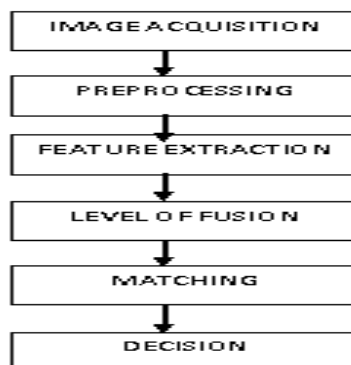- Level of Fusion
- Matching
- Decision

Figure 2: A multimodal Authentication system

A. *Image Acquisition*

The first stage of any biometric system is image acquisition ,where as in multimodal biometric system allow to ask user to give multiple characteristics as a input to the system like face ,fingers, hand, iris and etc. some of the biometrics and their acquisition hardware's are listed in the given TABLE 1 .

TABLE 1: BIOMETRIC TRAIT AND ITS ACQUISITION HARDWARE

Biometric	Acquisition hardware
Fingerprint	Finger print sensor
Face	Digital camera /face scanner
Iris	Iris scanner
Hand	Hand sensor/scanner
Voice	Micro phones/telephones
Palm vein	Palm vein sensor

B. *Feature Extraction*

In this stage features of various biometrics are extracted by applying various pre-processing techniques .But the techniques are to be differing according to the application and vendor and etc. Classification about various preprocessing techniques for each biometric shown in the below TABLE 2.

TABLE 2: CLASSIFICATION OF PRE-PROCESSING TECHNIQUES FOR DISTINCTIVE FEATURES EXTRACTION

Biometric	Pre-processing techniques	Distinctive patterns
Finger	Binarisation Segmentation Enhancement Minutiae extraction Orientation Thinning	Minutiae points: ridge ending Bifurication Cross over Island Delta
Iris	Segmentation Normalization Extraction of iris textures	Rings Furrows Freckles Corona
face	Face location Face recognition	Eye socket open ridge Cheekbone area Nose shape Mouth points
hand	Binarisation Segmentation Enhancement Morphological operations	Finger width Finger height Hand bone structure Joints distance

C. *Matching*

At finally the feature values are compared with those in the template by generating a matching score.

D. *Fusion*

In multimodal biometric system various levels of fusion existed are taking place those are listed:

- Sensor level,
- Feature level,
- Decision level
- Matching score level.

At the stage of sensor level fusion, multiple biometric traits are taken from different sensors and combined as one composite trait. In feature level fusion, feature vectors of the all processed multi biometrics collected and combined as one. In **decision level fusion**, every biometric classified independently and finally all it outputs are combined together. In matching score level fusion, matching score of individual modality is derived and fusion as a single matching score.

E. Decision

In which the user's identity is established or a claimed identity is either accepted or rejected based on the matching score generated in the matching module.

IV.   MULTIMODAL BIOMETRIC TECHNIQUES ON ATM SYSTEM

To enhance level of security in ATM some of the authors proposed following method and these are shown in following TABLE 3.

TABLE 3. EXISTED WORK ON ATM SECURITY WITH MULTIMODAL BIOMETRIC

Title	Author (s)	Metrics	Method of Fusion
A study on authenticated admittance of ATM Clients using biometrics based cryptosystem[11]	M. Subha S. vanithaasri	Finger print iris	Features of both finger and iris extraction fusion with cryptography
Privacy protected multimodal biometric based group authentication scheme for ATM [9]	B Shantini S. Swamynathan	Face finger print	Authentication done first with finger and then with face and then allow to give pin number to ATM
Multimodal Biometrics for Improving Automatic Teller Machine Security [8]	S. Pravinthraja Dr.K. Umamaheswari	Finger print face	Face feature s and finger features are extracted and applied holistic fusion with hidden markov model
Multimodal Biometrics using Feature Fusion[10]	Krishneswari, K. S. Arumugam	Palm finger	Palm and finger features are extracted and applied Bi orthogonal wavelet decomposition for fusion
A new application of multimodal biometrics supporting a highly secured and authenticated service in automated teller machine (ATM) [7]	S.Sangeetha S.Balgani K.Nathiya	Finger face iris	Face ,finger and iris features are extracted and applied holistic fusion

V.   STRENGTHS AND WEAKNESSES OF EXISTING WORK

M. Subha and S. Vanithaasri [11] proposed high secured authentication to the ATM customers by combination of multimodal biometrics and cryptogragy .In their method initially first features of finger and iris metrics are extracted and then generated multi modal biometric template with feature fusion .Finally key is generated for storing of template on to the database with cryptography technique. Results are not probably projected and simple technique applied for key generation.Multi stage group verification has been proposed by B Shantini and S. Swamynathan[12] with the usage of Multimodal biometric biometrics such as face and finger for ATM access. Three level of authentication process verification of person can be done efficiently. Even not attempted for fingers with low quality and also not considered facial expressions. A novel method was proposed by S. Pravinthraja and Dr. K. Umamaheswari [13] in which authentication of ATM customer done with multimodal

biometrics like face and finger and these are unique and traditional traits and produced better results than traditional system .The same method is produced even better results by deploying applications having large data base. Krishneswari, K. S. Arumugam[14] have done investigation on verification accuracy by considering both palm and finger traits. In their method level of fusion can be done by combing both palm and finger features and got accuracy almost 98.4% than traditional technique.A new application developed by S.Sangeetha S.Balgani and K.Nathiya [15] for ATM Customers recognition with mulitraits like face, finger and iris and .In this application all three possible features of traits are combined with holistic fusion and the same method even allow large number of users.

VI. CONCLUSION

Most of the banking applications will be running basis on biometrics and it is the only way to guarantee the presence of the customer when a transaction is made. For instance, multimodal biometric systems have been proven to be very effective in protecting information and resources in banking applications. Multimodal biometric systems can integrate information at various levels. At present, the amount of applications employing biometric systems is quite limited, mainly because of the crucial cost. In spite of all these the biometric-based recognition will have a great influence on the way we conduct our daily business in near future. Finally the comparative study on existing methods discoursed.

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