

Fraud Reduction in ATM Machines using Voice Recognition- A Review

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ABSTRACT: The evolution in banking and transaction system over the years has been enormous. The authentication, validation and confirmation of a person are of utmost priority and should be dealt with carefully. The first and the foremost thing that should be kept in mind is the security and confidentiality of the consumers. ATM (Automated Teller Machine) is the most widely used electronic equipment to carry out banking transactions. The dependence on ATM machines has increased considerably over the last three decades or so. In this paper, a system is proposed with an aim to enhance the security of ATM machines for safer transactions. In an ATM machine an identity test has to be passed before carrying out any transaction. The prevalent method for this identity test is the smartcard. This method secures the customer account against any fraud approaches by using the Personal Identification Number (PIN). But as a matter of fact many problems are also associated with smartcard authentication system. In order to deal with these problems, the use of voice as a biometric feature in ATM machines for secured transactions is proposed.

KEYWORDS: Automatic Teller Machine (ATM), Microphone, Mel-frequency cepstral coefficients (MFCC), Smartcard Access Control, Personal identification number (PIN), Voice-Dependent Access Control and Verification Systems.

I. INTRODUCTION

Recently there has been a tremendous increase in use of biometric features such as voice, fingerprints, face, iris etc in recognition systems. The development of ATM machines pertain to keep in check the prevalent issues in the banking system: Fairly large queues on the cash counter, faster access to cash withdrawal, 24 hours banking service, and enhancement in the quality of services to the customers. The most important concern since the introduction of ATM is the safety of customer's funds in the bank account. Presently the only method for authentication is the smartcard but it has some problems associated with it too. It is highly improbable to restrict any person from acquiring and using a legitimate individual's smartcard. Also, the smartcard can be misplaced, destroyed, stolen, or even duplicated.

A voice-dependent access control system will help in verifying the authenticity of a person by the electronic assessment of voice characteristics of the person concerned. Of late, the biometric methods used to remove the loopholes associated with the smartcard and for validation of legitimate person for ATM access include face, voice, hand-shape, fingerprint and iris. This paper discusses a voice-dependent ATM access control system which can provide correct verification of identity from individual's voice characteristics. The preference of voice as a biometric feature is there because it is easily accepted by the users, can be recorded by any voice sensor, the hardware costs are reduced significantly etc.

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Following are the problems associated with smart card access control:

- a) **Magnetic stripe or chip distortion:** The magnetic stripe or chip contains the information that is required for the card to function. There is a chance of distortion of the magnetic surface of the card because of excessive use or false handling. This distortion may damage the card and make the card useless.
- b) **Misplacement of the card:** Smartcards can get misplaced and hence the person will not be able to access the ATM.
- c) **Card Stolen:** The smartcard could also be stolen along with the PIN number. There have been a few reported cases of burglar's forceful possession of the smartcard and PIN number from the legitimate person and even forcefully taking these people to the ATM location to confirm the authenticity of ATM number given to them.
- d) **Card fraud:** Fraudsters are making use of various methods in perpetuating the crime related to smartcards. The easiest is to steal an ATM card. A latest method involves trapping the card inside the card holder. The latest advancement in fraud in ATM involve the installation of a magnetic card reader over the real ATMs card slot and then making the use of a wireless surveillance camera to observe the user's smartcard PIN number. Card data is then cloned out on a different card and the fraudster attempts the crime.

VOICE RECOGNITION SYSTEM:

Voice Signal Identification transforms a speech signal into features which aid the further processing. Quite a number of algorithms and techniques are used for the same[1]. The ability of a system or program to receive as well as interpret dictation, or to understand and follow the spoken instructions, is termed as Voice Recognition. In general, it is regarded as one of the convenient and safest recognition techniques[2]. The basic block diagram for voice recognition is given in Figure 1. A big challenge of proliferating accuracy and recognition speed is faced by the real time automatic system for speech recognition. Degradation in performance of speech recognition system occurs due to noise. Also it is affected by modifying speech data due to dependence on speaker's gender, environmental conditions and style in which it is spoken. The accuracy of recognition depends on the method of feature extraction and training, so one of the core issues of speech recognition research is the recognition accuracy. Development of speech recognition system with less recognition time and high recognition accuracy is the aim. Moreover, system performance improves in the presence of noise with the use of noise robust feature extraction and training technique[3].

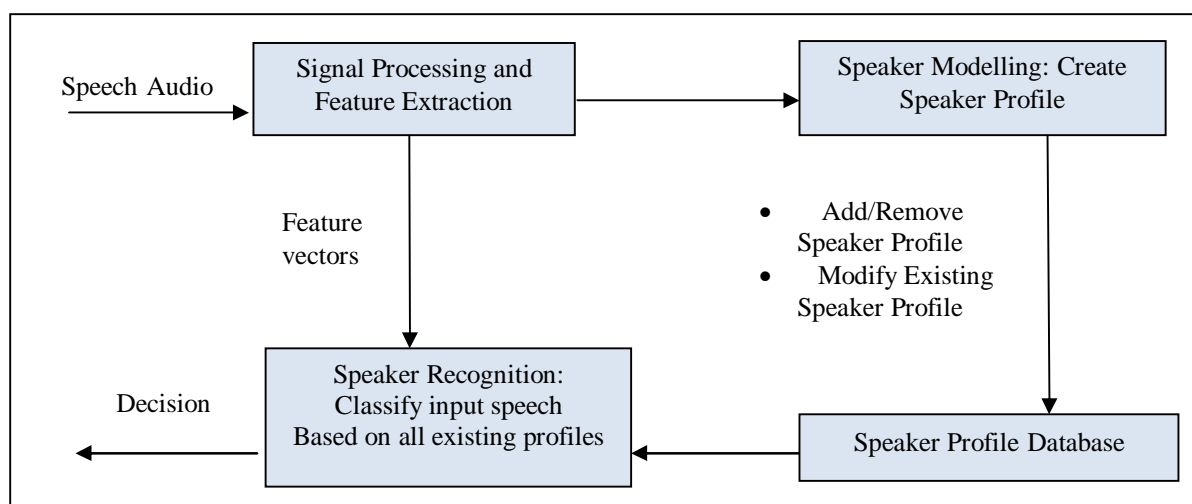


Figure 1: Voice recognition System

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A two-factor authentication of an individual can help voice to combine what masses say and the way in which they say it. Other identifications such as fingerprints, handwriting, iris, retina, face scans can also help, whilst voice identification is required as an authentication that is not only secure but unique also. Voice recognition systems are economical and easily understood by users[4].

MEL FREQUENCY CEPSTRAL COEFFICIENTS (MFCC): A vital task in producing a better recognition system is dependent on the extraction of the best parametric representation of the acoustic signals. MFCC is dependent on human hearing judgement which cannot receive frequencies above 1 KHz. In other words, MFCC is dependent on known variation of the human ear's critical bandwidth with frequency[1]. The overall process of MFCC is shown in Figure 2.

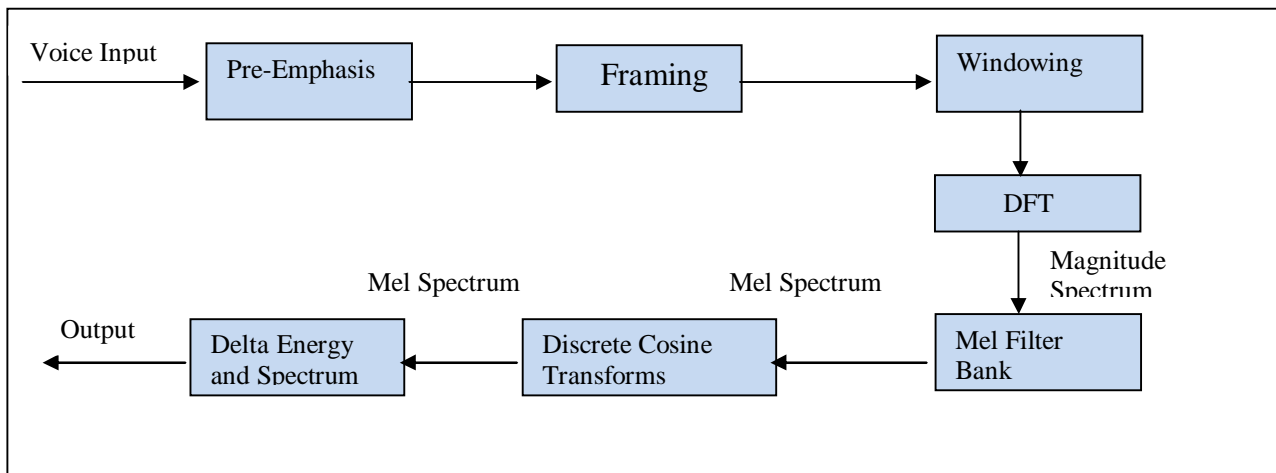


Figure 2: MFCC Block Diagram

II. RELATED WORK

In this section, work related to voice dependent control system for ATM has been discussed:

Yekini NA et al. (2012) presented a voice-dependent access control system for ATMs. Figure 3 shows the block diagram of the discussed system. The system consists of 3 important components: Voice sensor e.g. microphone, speaker verification system and access control system for ATM machine. A low cost voice sensor is used to record the ATM user's voice and subsequently send it to the voice-dependent verification system to validate the authenticity of the user[5].

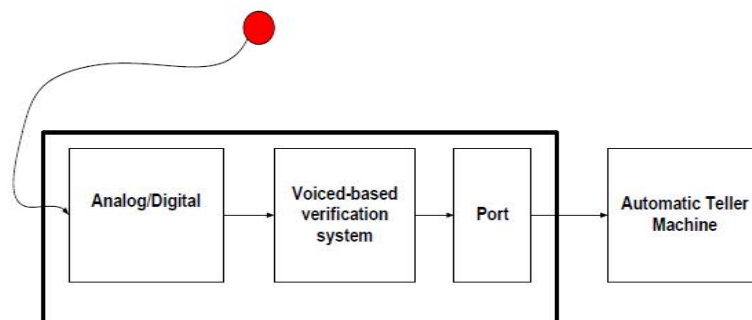


Figure 3: Voice-based ATM control

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S. Iqbal et al. (2011) made use of MFCC technique for extracting unique and reliable voice features in the form of Mel coefficients. It is based on two security measures, PIN number as well as voice features to provide more security to the ATM transactions. It represents the best possible efficiency of 86.67% with the error rate of 13.33% [6]. H. Venugopal et al. (2012) used the concept of voice recognition in ATM machine to carry out secured transaction. They discussed a security based implementation of Hidden markov model algorithm (HMM) to measure speech rate, frequency and modulation pitch detection algorithm (PDA) for calculating pitch of voiceprints and Accent Classification (AC) for the analysis of accent in voice. There was a noticeable increase of 15% in accuracy as compared to other prevalent systems[2].

R. Chavan et al. (2013) tested upon own created database in different surroundings. The recognition accuracy increases due to the combination of MFCC and HMM. The performance is evaluated by finding word wise accuracy for five different speakers[3]. The accuracy varies from word to word, here the accuracy obtained for first two words is 92% and third word is 88%. A. Patil (2014) discussed the importance of security during ATM transactions. A major concern is the accessibility of ATM machines to differently-abled people. These concerns can be overcome by using iris recognition for authentication and voice enabled transactions in ATM machines. Once the authenticity of the user is verified, the user is allowed to carry out further transactions using voice based commands by speaking into a microphone[7].

C. Upadhyaya et al. (2014) observed that MFCCs for every individual user was unique. Few variations were observed due to different surroundings of the recording area. Then the MFCCs of the stored template and real time input are compared for every user[4]. In programming, Euclidean distance is used to compare the template and real time input. In this manner, MFCC algorithm is used for voice recognition. R. Kavitha et al. (2014) discussed that voice dependent authentication system for Tamil language has two main phases, feature extraction phase and feature matching phase. Feature extraction phase enables the system to extract the MFCC features from the input sample. While the feature matching module identifies the Tamil words and the user by making use of Dynamic Time Warping algorithm that measures the warping distance between the two sequences[8].

A. H. Mansour et al. (2015) discussed DTW as a flexible mathematical method and gave high accuracy results. The signal analysis by using MFCC provides us by spectrum coefficients which represent the accurate vocal system for the stored word, with a high level of perception for the human voices. The spectrum coefficients has a high specification which shows their importance depending on the speaker himself[9]. So the back propagation algorithm has been tested for the voice recognition, and has achieved a success rate about 95%. W. Astuti & E. Riyandwita (2016) evaluated the effectiveness of an automated voice-dependent engine starting system. 12 Cepstral coefficients are used in order to obtain the MFCC coefficients. These filters are simulated by integrating the Fast Fourier transform spectrum of 20 millisecond Hamming-window voice segments in which the frame rate is 10 milliseconds. The training as well as the testing accuracy of the system achieved 98% and 92.15%, respectively[10].

TABLE 1: Comparison of Various Techniques used for Speech Recognition System:

Reference	Technique Used	Results
S. Iqbal et al. (2011)	MFCC, HMM Log Likelihood	Efficiency of 86.67% with error of 13.33%
H. Venugopal et al. (2012)	MFCC, Pitch Detection Algorithm(PDA), Accent Classification(AC)	15% increase in accuracy as compared to prevent methods

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R. Chavan et al. (2013)	MFCC, Hidden Markov Model(HMM)	92% accuracy for 2 weeks and 88% for the 3rd word
A. H. Mansour et al. (2015)	Discrete Time Warping(DTW), MFCC, Spectral Coefficients	Voice recognition Success rate of 95%
W. Astuti & E. Riyandwita (2016)	MFCC, FFT transform, Arduino, Vector support Table	Training accuracy of 98% and testing accuracy of 92.15%

III. PROPOSED WORK

After studying the prevalent systems and their inaccuracies and results, a system is proposed which will help in creating a secured ATM access by ruling out the problems associated with the smartcard authentication system. The block diagram of the system is given in Figure 4. The system consists of user training and database of an authorised person. This will be then compared to the real time voice input through microphone. The comparing process is carried out by feature extraction and feature matching with that of stored samples of authorised customer in the database. If the matching is positive then the access to the ATM machine is enabled using an embedded design.

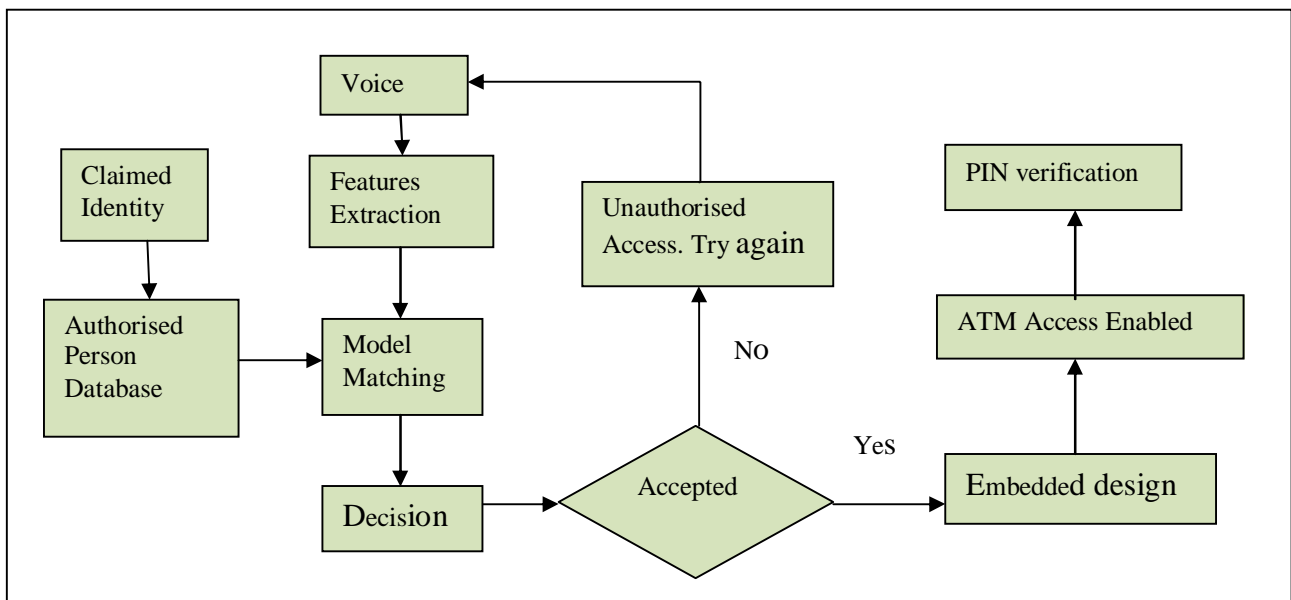


Figure 4: Block Diagram for Proposed System

IV. CONCLUSION

Nowadays, ATMs have become a definite requirement for carrying out millions of transactions that happen in day to day life. Large number of frauds can be carried out in ATM machines, significantly because of PIN disclosure or forceful collection. This paper presents a conceptual framework that uses voice-dependent access control system in ATMs. Recent studies have shown that ATM users have come across many problems in day to day life which include; chip distortion, card misplacement. Card fraud etc. These problems are mainly associated with the smartcards. In order to overcome these problems, it is highly recommended that the banking sector should make the use of voice biometric

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technique in ATMs, as this will eradicate the loopholes that are prevalent in current system that uses smartcard to access an ATM. So, the proposed system will not only improve the security during money transactions but also make ATMs user friendly for the less educated. This method when fully taken into practise will not only enhance secured and correct authentication, but will also render support in the implementation of complex ATMs (performs deposits and money transfer), as this system provides enhanced security.

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