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Comparative Analysis of Facial Recognition and Personal Identification Number Automated Teller Machine Cards

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Authors' contributions

This work was carried out in collaboration between both authors. Author OO designed the study and wrote the protocol. Author AA supervised the work. Both authors read and approved the final manuscript.

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Short Research Article

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Abstract

This paper carried out a comparative analysis between the existing ATM system with its PIN mode of security and an ATM system with a facial recognition module so as to judge their efficiency security wise. Face recognition was introduced into the ATM system to the security concern associated with the existing ATM system. An ATM system with a facial recognition scheme is simulated and comparison is carried between the new system and existing system through a user based assessment with questionnaire distributed to gauge the efficiency of both systems and the level of satisfaction of the users based on the performance of both systems. The results obtained shows that the new system guarantees more security, privacy and confidentiality than the existing system.

Keywords: Biometrics; cryptography; crypto-biometrics.

1 Introduction

Automated Teller Machine cards are used for business transaction. These cards are used with their Personal Identification numbers (PIN) to grant access into banks account. However the vulnerability of the ATM card

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once the PIN is known has given rise to the rate of criminal activities at ATM points. This particular problem can be addressed through biometric based authentication for users of ATM cards. Face recognition technology is a biometric technology that uses the facial image or images captured on a camera or any other form of photography for recognition. Face recognition is a vast and modern research area that involves image processes pattern recognition and computer face recognition has a wide range of applications such as surveillance, access control, e- passport and human computer. Facial features has the highest compatibility of the six biometric attribute in a machine readable travel document and this is due to the fact that the face recognition compared to other biometric technologies is non- intrusive and easy to use [1]. In the paper a comparative analysis is done between ATM with the facial recognition module and ATM with the PIN system.

2 Related Works

Face recognition system has been in existence since the beginning of time as the human face is the most obvious human identifier and key to human identification but the first attempt at face recognition towards authentication was introduced in 1976 by Goldstein, Harman and Lesk by using 21 specific markers such as hair colour, lip thickness to automate the recognition process but the system has the disadvantage of all the features being manually identified and computed. The intrusive way to recognize the face is to extract major features from a face and compare it with the same feature on other faces. Brunnelli R and Poggio T [2] used template matching for biometric recognition of the human face. The algorithm prepared a set of four masks representing the eyes, nose, mouth and face for each registered person: For identification of the unknown person, the algorithm detected the eyes first users template matching and then normalizes the position, scale and rotation of the face in the image plane using the detected eye position Most of the related works done on the biometric authentication of ATM cards has been done using the fingerprint as the biometric trait. Subh MC and Vanithassri [3] proposed a highly authenticated biometric security system, they used a method of conventional fingerprint static points i.e. feature and minutiae point for authentication during ATM access. Bhosale ST and Sahari BS [4] and Ibiyemi TS et al. [5] developed two models for ATM biometric authentication which were used in place of card system with biometric technology. The proposed system merged feature based fingerprint, iris and PIN authentication to provide reliable ATM authentication. Amurthy PK and Reddy MS [6] developed an embedded fingerprint system which was used to secure ATM application, bankers biometric data and mobile phone numbers were collected while opening a bank accounts of PIN based ATM authentication. Santhi B and Kumar RK [7] presented a secure ATM method with secured personal identification image, characteristic features of fingerprint were used to overcome the constraints of PIN based ATM authentication.

3 Materials and Methods

In the research work, an ATM system with PIN mode of security and an ATM system with the facial recognition mode of security are simulated and a comparative analysis of both systems are done through a user based assessment with the use of questionnaire prepared in a four point Likert format. In order to carry out the analysis questionnaire of 200 respondents is distributed in about three different locations which are Osogbo, Ibadan and Abeokuta in Nigeria. The ATM user's responses were based on the level of efficiency of ATM cards from Security for ATM cards, Ease and convenient usage of ATM cards, Users friendliness of card, Privacy and confidentiality of card, convenient hours of operation, steps in processing transaction, and Clarity of instructions of the ATM systems. The statistical analysis is done using weighted mean score.

The Fig. 1 shows the interface for the ATM system with the facial recognition module incorporated into it, the figure shows the creation of the ATM card with face incorporated into it to replace the PIN mode of security of the ATM system.

The Fig. 2 is a biometric authentication mechanism used to authenticate ATM user. Instead of using the PIN when the user/customer has inserted the card into the card reader, the user will be prompted to take a snapshot from the system camera, which will compare the extracted feature with the already stored template using facial recognition mechanism.

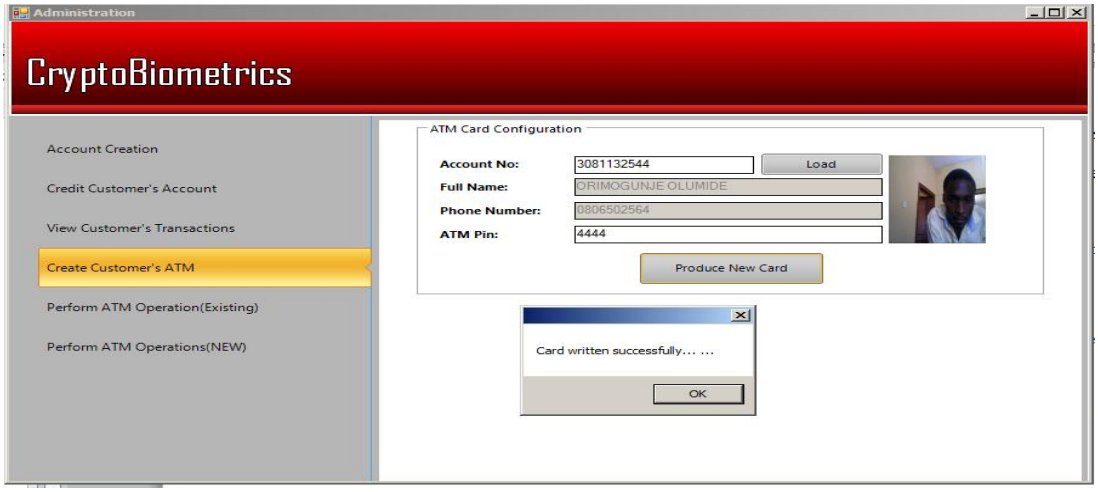

Fig. 1. ATM Interface with the Biometric scheme

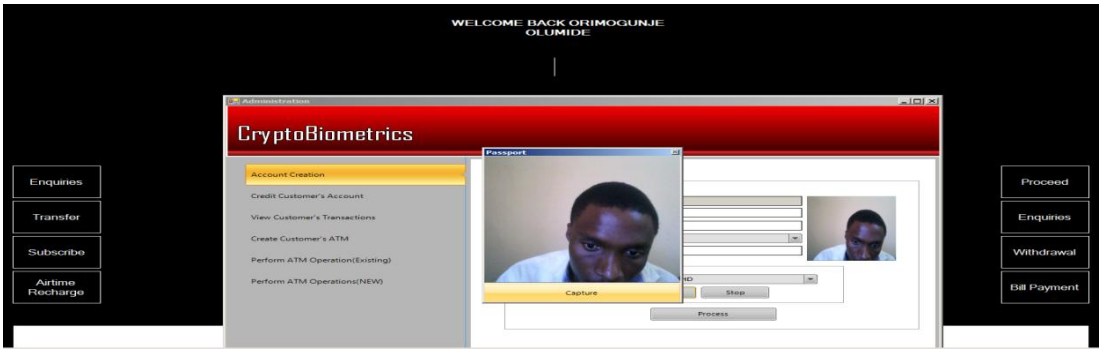

Fig. 2. ATM Interface with biometric authentication

Table 1 revealed that 59.80 per cent of the respondents were male, while only 40.20 per cent were female. This implied that male used ATM banking services than the female counterpart. Majority (28.14 per cent) of ATM banking users age range were found to be between 21-30 years, 20.10 per cent for age range 31-40 and 41-50, while only 12.06 per cent were found to be less or equal to 20 years. About 39.70 per cent frequently use ATM banking services more than 12 times within a month, while only 20.10 per cent use the services between 1-4 times, 5-8 times and 9-12 times respectively. The table also revealed that 40.20 per cent of the users identified "easy and convenient usage of ATM cards" as the major factors influencing the use of New ATM card technology, while 20.10 per cent found cost effectiveness and security to be a major factor influencing the use of new ATM card technology, only 19.60 per cent found reduced time of transaction as the major factor influencing the use of new ATM card technology.

4 The Results

The ATM user's responses based on the level of efficiency of ATM cards from Security for ATM cards, Ease and convenient usage of ATM cards, Users friendliness of card, Privacy and confidentiality of card, Convenient hours of operation, steps in processing transaction, and Clear instructions given are presented in Table 2 below. The table revealed that 67.84 percent of the respondents found the security of ATM cards to be efficient, about 60.30 percent found it very easy, convenient and friendliness to use. Majority (73.87 percent) of the users found ATM cards more confidential and were satisfied with the number of hours for its

operation. About 59.80 per cent of the users found it that it takes many processes for a complete transaction with the card and finally about 40 per cent were indifferent in response to the clear instruction of the machine.

Table 1. Demography and the use of ATM banking services

Gender	Freq.	Percent	Cum.
Male	119	59.80	59.80
Female	80	40.20	100.00
Total	199	100.00	
Age of the customers (years)			
<=20	24	12.06	12.06
21-30	56	28.14	40.20
31-40	40	20.10	60.30
41-50	40	20.10	80.40
Above 50	39	19.60	100.00
Total	199	100.00	
Frequency use of ATM banking services			
1-4 times	40	20.10	20.10
5-8 times	40	20.10	40.20
9-12 times	40	20.10	60.30
Over 12 times	79	39.70	100.00
Total	199	100.00	
Factors influencing the use of new ATM card technology			
Reduced time of transaction	39	19.60	19.60
Ease of use	80	40.20	59.80
Cost effective	40	20.10	79.90
Security	40	20.10	100.00
Total	199	100.00	

Table 2. Responses of ATM users based on Satisfaction derived from the service

	Extremely satisfied	Satisfied	Neutral	Dissatisfied
Security	36 (18.09)	99(49.75)	32(16.08)	32(16.08)
Easy use	40 (20.10)	80 (40.20)	39 (19.60)	40 (20.10)
Friendliness	40 (20.10)	80 (40.20)	39 (19.60)	40 (20.10)
Privacy	119 (59.80)	28 (14.07)	28 (14.07)	24 (12.06)
Hours	119 (59.80)	28 (14.07)	28 (14.07)	24 (12.06)
Steps	40 (20.10)	79 (39.70)	40 (20.10)	40 (20.10)
Instruction	39 (19.60)	40 (20.10)	80 (40.20)	40 (20.10)

Source: Field survey, 2014

Table 3 shows the result of the comparison between the existing framework (ATM with PIN authentication) and the developed framework (ATM with crypto biometric authentication). The comparison is based on the justification of the respondents to the questionnaire so as to be able to determine the rate of efficiency and the preference of both systems. The results obtained shows that the developed system has higher efficiency rates and is deemed to be more effective than the existing framework and preferred it to the existing system in terms of security, ease of use, friendliness, privacy, steps in processing transaction and clarity of instructions with percentage ratings of 99, 80, 80,28, 79 and 40 as against the percentage ratings of 36, 40, 40, 19, 40 and 39 of the existing framework. However the existing system has higher a efficiency rate and is deemed to be more effective in terms of convenient hours of operation with a percentage value of 59.80 against 28 for the developed system.

Table 3. Comparison of Existing Framework (ATM with PIN) and New Framework (ATM with crypto biometric authentication)

Parameters	Existing platform	New platform
Security	36%	99%
Easy use	40%	80%
Friendliness	40%	80%
Privacy	19%	28%
Convenient Hours of Operations	59.80%	28%
Steps in Processing Transaction	40%	79%
Instruction	39%	40%

5 Conclusion

The paper presents a comparative analysis of the ATM system with biometric authentication and the existing ATM system, that is, ATM system with PIN mode of security. The objective of the paper is to compare the performance of and preference for both systems majorly on their security, privacy and confidentiality. The analysis is described in details with a user based assessment through the use of questionnaire to gauge the performance and level of satisfaction derived from the performance of both systems and the ATM system with the biometric mode of security was preferred to the existing system. A facial recognition module was deployed into the ATM system and simulated for users and their opinion showed that biometric which is defined as a unique, measurable, biological characteristic or trait for automatically recognizing or verifying the identity of a human being and facial recognition was preferred as a tool to authenticate ATM users under instead of using the old existing method which is PIN authentication process because it guarantees more security, privacy and has a better general overall performance. Biometric authentication identifies customers by their biological traits. More specifically, biometric technology is an application that uses individuals' characteristics and traits to identify them and control their access to various systems. This however will stop the problem of identity theft and ease convenience on the part of the user but most of the banks especially in Nigeria are still using the method of PIN authentication, it is therefore recommended that the banking sector with third party companies that produce ATM card should take a step in incorporating biometrics into ATM card services.

Competing Interests

Authors have declared that no competing interests exist.

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