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Enhanced Automated Teller Machine Using Short Message Service Authentication Verification

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***Abstract*—**The use of Automated Teller Machine (ATM) has become an important tool among commercial banks, customers of banks have come to depend on and trust the ATM conveniently meet their banking needs. Although the overwhelming advantages of ATM cannot be over-emphasized, its alarming fraud rate has become a bottleneck in it's full adoption in Nigeria. This study examined the menace of ATM in the society another cost of running ATM services by banks in the country. The researcher developed a prototype of an enhanced Automated Teller Machine Authentication using Short Message Service (SMS) Verification. The developed prototype was tested by Ten (10) respondents who are users of ATM cards in the country and the data collected was analyzed using Statistical Package for Social Science (SPSS). Based on the results of the analysis, it is being envisaged that the developed prototype will go a long way in reducing the alarming rate of ATM fraud in Nigeria.

***Keywords*—**ATM, ATM Fraud, E-banking, Prototyping.

I. Introduction

THE traditional and ancient society was devoid of any monetary instrument and the entire exchange of goods and merchandise was managed by the "barter system". The use of monetary instrument as a means of exchange has now replaced the barter system and money in various denominations is been used as the purchasing power. Before the emergence of modern banking system, banking operations were done manually leading to a slow-down in settlement of transactions, this manual system involves posting transactions from one ledger to another which were handled by human beings. Later, most banks started using only one Computer in carrying out transactions thereby ameliorating (improving on) the sluggish nature of banking transactions. All these were not only time consuming, it also reduced accuracy as a result of human errors.

The new millennium brought with it new possibilities in terms of availability and accessibility of information simultaneously introducing new challenges in protecting sensitive information from some eyes and making it available to others. The evolution of electronic banking which can be defined as a system through which transactions are settled electronically with the use of electronic gadgets such as ATM, POS etc has become synonymous with today's banking and financial transactions. Unlike in the time past when a bank's customer needs to go in person to a branch of a bank, he need to be present right in the banking hall in front of the bank's cashier before any transaction could be made, today's electronic payment system especially the use of ATM has changed all that [2].

ATM has remained the most patronized banking transaction channel in the country accounting for over 80-90% of the total e-payment transactions in Nigeria. Its safety, convenience and ease in settlements of bills and online transactions has unfortunately been lessened by the frauds that are penetrated by these plastic money [9] thereby leading to an undermined customers confidence and a major problem in its full adoption in the banking sector [2].

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II. Objectives

The major objectives of this paper are:

a) To develop an enhanced ATM authentication prototype using SMS verification.
b) To examine the usability of the developed prototype

III. Literature Review

Automated Teller Machine is a 24 hour teller machine with electronic terminals that allow bank transactions almost every time thereby making cash withdrawals or transferring of funds between accounts possible through the insertion of ATM card and personal identification (PIN). The ATM therefore performs the traditional functions of bank cashiers electronically in real time. A research was carried out and it was asserted that ATM services are highly profitable for banks and hence, banks aggressively market the use of ATM cards [11], [13]. They further stated that off premise ATMs are usually more profitable for banks because it attracts a higher volume of non-bank customers who must pay service fees, unfortunately for the customers using this off premise ATMs, they are more vulnerable to robbery they concluded.

Investigations into electronic payment system and telebanking services in Nigeria revealed that there has been a very modest move from cash, payments are now been automated with volumes of cash transactions reduced. The introduction of ATM was applauded by several customers as a suitable substitute to the frustrating queues that portray the country's banking halls in the past.

The benefits of ATM usage in numerous ways include:

a. Flexible account access.
b. Increase in hours of operation to fit client schedules.
c. Many clients can reach beyond the branch network.
d. Bank personals are not required to be present for transactions and they will have to serve other customers in the banking hall.

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e. Convenient way of banking.
f. Reduction in armed robbery attacks.

Despite the enormous benefits derivable from the ATM, the emerging challenges of ATM fraud have continuously threatened to silence its continued [2]-[6]. The menace of ATM frauds in Nigeria was blamed on indiscriminate issuance of ATM cards to customers without regards to the customer's literacy level. Reference [14] sees the new and additional cost of running ATM machines in the country in the cost of the ballooning ATM fraud rate. Concern on the rising ATM fraud rate in the country as the security measures adopted by banks are obsolete thereby making the measures insignificant and allowing increasing fraud rates at the ATM centers was expressed [7], [10]. As the technology of ATM keep developing, the fraudsters also keep improving on ways of carrying out crime while banks are observed not to be putting sufficient measures of control place to avoid fraud at ATM centers.

It was opined that if the current upsurge and nefarious activities by ATM fraudsters is not checked, it will result into massive dumping of ATM cards by customers [12]. It was explained that it is disheartening to note that ATM frauds have been successful due to the support and collaboration provided by unscrupulous internal employees of banks, this means that for a longtime, these unbudgeted losses by the customers and banks will continue while the banks are suffering reputational loss [8]. Previous researcher described the high level of ATM fraud in Nigeria as a big shame when most (if not all) of the fraudulent activities could be checkmated or prevented [10].

Five (5) security loopholes in ATM usage are identified [1], [2], these security loopholes are found in:

a. ATM software
b. ATM hardware
c. Poor ATM implementation/ maintenance
d. Physical access security loopholes
e. Debit/ Credit and PIN loopholes.

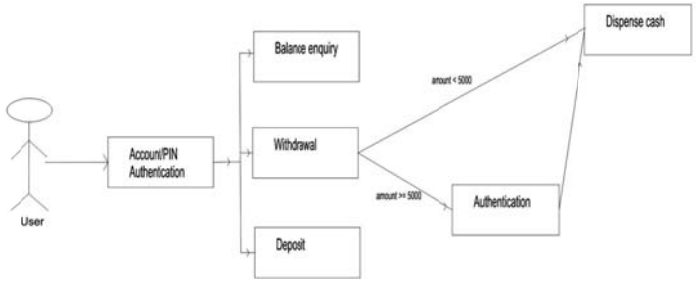


Fig. 1 Interface (use case)

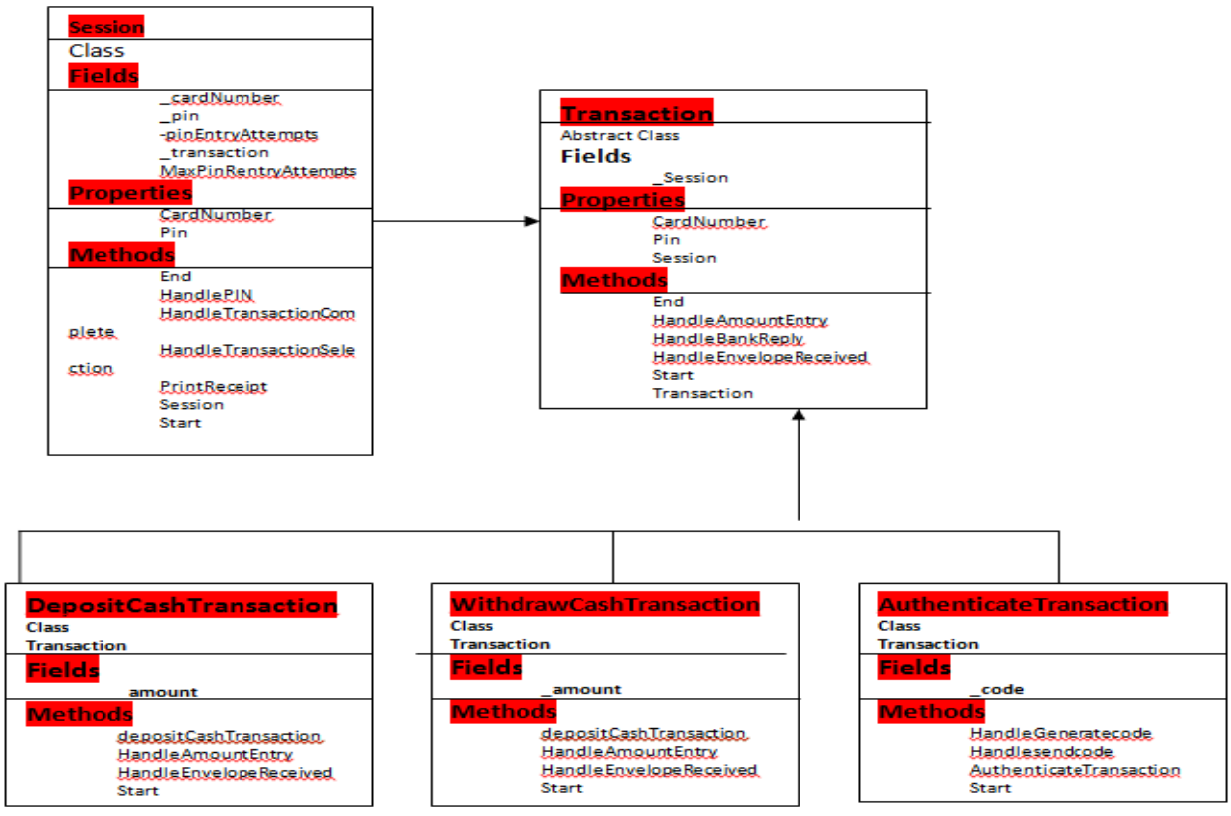


Fig. 2 Class Diagram

IV. Algorithm

The algorithm which is been shown with the aid of a flow chart is as summarized as follows:

(1) Given an ACCOUNT NUMBER and the corresponding PIN, check the bank database to verify the existence of the ACCOUNT NUMBER, it then checks if the

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corresponding PIN is valid for the ACCOUNT NUMBER.

(2) For an existing ACCOUNT NUMBER and its valid PIN, Select an operation of (1) Balance Inquiry (2) Deposit and (3) Withdrawal.

(3) For Withdrawal Operation, if the amount to be withdrawn is greater than #5,000, the ATM automatically generates a four digit random code, stores the code as the authentication code and send to the phone number corresponding to the account number. However, if the amount to be withdrawn is less than #5,000, the machine dispenses cash immediately.

(4) For a given authentication code, the ATM compares it with the stored authentication code generated and if valid, it dispenses cash.

V. Usability Testing

The usability testing of this research was carried out using Heuristic Evaluation Based on a Questionnaire for User interface satisfaction designed by previous researchers [15].

V. Data Analysis

For the purpose of clarification and clarity, the questionnaire was divided into four (4) parts:

a) The General Description of the System
b) The Description of the Screen
c) Terminology and System Information
d) Capabilities of the new system

The data gathered is both descriptive and statistical which involves the use of minimum, maximum and mean.

TABLE I
General Features

	N	Minimum	Maximum	Mean
Flexible	10	1.00	2.00	1.8000
Secured	10	1.00	2.00	1.7000
Easy	10	1.00	3.00	1.7000
Satisfying	10	1.00	2.00	1.6000
Wonderful	10	1.00	2.00	1.5000
Valid N (list wise)	10			

As shown in Table I, since the mean of the new system's flexibility, security, easy operation, satisfaction and being wonderful falls between 1 (strongly Agree) and 2 (Agree), the system is perceived to be flexible, secured, easy to operate, satisfying and wonderful.

TABLE II
Screen Descriptive Statistics

	N	Minimum	Maximum	Mean
SCREEN3	10	1.00	2.00	1.8000
SCREEN1	10	1.00	2.00	1.6000
SCREEN2	10	1.00	2.00	1.5000
Valid N (list wise)	10			

As described in Table II, the clarity, eligibility and arrangement of information on the screen are perceived to be very clear, easy and well organized since their mean values falls between 1 (Strongly Agree) and 2 (Agree).

TABLE III
Terminology and System Descriptive Statistics

	N	Minimum	Maximum	Mean
TERMS7	10	2.00	4.00	2.9000
TERMS3	10	2.00	2.00	2.0000
TERMS6	10	1.00	3.00	1.9000
TERMS2	10	1.00	2.00	1.9000
TERMS5	10	1.00	2.00	1.8000
TERMS4	10	1.00	2.00	1.8000
TERMS8	10	1.00	2.00	1.7000
TERMS1	10	1.00	2.00	1.6000
Valid N (list wise)	10			

As described in Table III, exploring new features by trial and error is perceived to be difficult as it's mean value of 2.9000 falls between Agree and Disagree. Prompts for input, learning to operate and message positioning are perceived to be very clear, very easy and consistent respectively since their mean falls between 1 (Strongly Agree) and 2 (Agree). Also, error messages generated when user enters an invalid PIN or option is perceived to be helpful as it's mean of 1.800 also falls between Strongly Agree and Agree. The System is perceived to be good at informing the user about the progress of the system, straight forward in performing of tasks and the terminologies used for the new system are perceived to be well related as their mean falls between 1 (Strongly Agree) and 2 (Agree).

TABLE IV
System Capabilities Descriptive Statistics

	N	Minimum	Maximum	Mean
CAPABILITY4	10	1.00	3.00	2.1000
CAPABILITY3	10	2.00	2.00	2.0000
CAPABILITY2	10	1.00	3.00	1.7000
CAPABILITY1	10	1.00	2.00	1.6000
Valid N (list wise)	10			

As depicted by Table IV, it is being perceived that the system is designed for all levels of users, easy in correction of mistakes, reliable and has a high speed in completing tasks as it's mean values lies between 1 (Strongly Agree) and 2.1 (Agree/ Not sure).

V. Conclusion

The adoption of Automated Teller machine usage in electronic banking has enhanced Bank's efficiency by making banking transactions more productive, effective and convenient as customers now have access to their account outside working hours to make withdrawal to attend to their needs.

The impact and effectiveness of ATM in electronic banking can't be overemphasized as it plays a dominant role in communicating good and quality services to the customers. If proper funding to the means of finding a lasting solution is being offered to reducing to the barest minimum the alarming

rate of ATM fraud by banks, it will help the banking sector achieve their marketing and corporate objectives.

The implemented enhanced ATM using short message service verification alert in this research work is not an absolutely reliable means for checking the menace of ATM fraud in Nigeria as network failure or fluctuations in the mobile network provider can truncate the whole transaction process.

RECOMMENDATION

Although the implemented prototype is not an absolutely reliable means of putting an end to the menace ATM fraud in the country, however, government participation in ensuring a focused telecommunication industry void of failure and fluctuations will help the developed prototype in reducing to the barest minimum the fraud rate in ATM services if it cannot eliminate it completely.

Regulatory authorities like the Central Bank of Nigeria (CBN) should stipulate more standards and protocols for the banks to follow on the use of ATM.

Government should also work on the unemployment rate in the country by creating jobs, opening skill acquisition centres, empowering the skilled etc. because the an idle mind is the devil's workshop.

Customer's satisfaction should be the watchword for banks because customers are king in any business organization. Hence, the banking industry needs to go extra miles in finding a lasting solution to the alarming rate of ATM fraud.

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