Design and Implementation of ATM Emulator

1C.H. Ugwuishiwi
Department of Computer Science
University of Nigeria
Nsukka, Nigeria
chikodili.ugwuishiwi@unn.edu.ng, 08030998078

2M.E. Ezema
Department of Computer Science
University of Nigeria
Nsukka, Nigeria
modesta.ezema@unn.edu.ng, 07037951472

3N.G. Ugwuegbu
Department of Computer Science
University of Nigeria,
Nsukka, Nigeria.
nugwuegbu@yahoo.co.uk, 08035660292

1Corresponding Author

ABSTRACT

An ATM is a self service technology in financial service delivery usually adopted by financial institutions to reach their customers outside the banking hall. The study simulates the operations of an Automated Teller Machine (ATM). Minimal assumptions were made about the working of the ATM, the study used a personal computer (PC) for the simulation and information in the database are records of bank customers. The methodology used is object oriented analysis and design methodology (OOADM) and the analysis tool used is UML. All basic operations of the ATM hardware devices were encapsulated by the software including deposit operation that is not currently functional in our present ATM operation. This software can be integrated with the ATM hardware at a later time. The study showed that ATM can effectively, efficiently and reliably handle almost all forms of financial service delivery to bank customers.

Keywords: ATM, Emulator, Financial institution, Software, Bank Customer, Transaction.

1. INTRODUCTION

An Automated teller machine (ATM) is a term used to describe an electronic banking outlet, which allows customers to complete basic transactions without the aid of a branch representative or teller. It was developed as a result of need for self service technology (SST) in financial service delivery by financial institutions, (Mushabati, 2008). In the manual banking, transactions are done in a way that customers walk into the bank to fill tellers, withdrawal booklets or cheque. Customers’ transactions are based on paper, thus manual banking is time consuming and lacks efficiency in record keeping giving room for manipulations.

Despite availability of other banking technologies; internet banking, and mobile banking, the demand for cash remains high and bank branches are rising continually worldwide as customers demand cash to be accessible at different locations. These banking technologies such as internet, mobile and traditional banking cannot allow customers to have access to their cash at convenient. The poor internet access and the cost of procuring the facilities to use both the internet and mobile banking such as computer or sophisticated mobile phone are also barrier in using such technologies.
In order to enhance productivity and achieve cashless economy, the Central Bank of Nigeria (CBN) in July 2004, mandated commercial banks operating in Nigeria to install Automated Teller Machines (ATMs) in the bank premises and other strategic locations to serve their customers, (Okafor and Ezeani, 2012).

The objective of the study is to design and implement an ATM Emulator that will simulate the basic operations of an ATM such as withdrawal, balance inquiry, deposit, fund transfer, GSM recharge, etc, in order to improve bank service delivery. ATM emulator is software that mimics the functions of an ATM system, so that the emulated behaviour resembles the behaviour of the ATM. The ATM emulator does not have the ATM complete hardware implementation rather, it will be simulated with a PC which will serve as a dedicated system, and the monitor will perform the function of the ATM screen which is to display transaction messages to the customers.

ATM creates a paperless office, ensures security of customers’ accounts and privacy, it grants customers 24-hour access to their accounts, eliminates cash induced robbery, it reduces cost of operation and enhances proper and effective record keeping. ATM allows you to do a number of banking operations such as withdrawing cash from one’s account, making balance inquiries and transferring money from one account to another using a plastic, magnetic-strip card and personal identification number issued by the financial institution, (Sultan, 2009).

2. LITERATURE REVIEW

ATM is a technological advancement that has brought about change in the way banks render services to their customers. ATM was introduced to automate banks operations, to enhance efficiency and effectiveness and on the long run, reduce costs and saves time.

Richard (2011) stated that ATM is a “must have” service channel for financial institutions. Without it, the financial institution is not even a viable choice for most customers.

Mary (2008) discussed recent development in ATM industry especially the improvement from the OS/2 operating systems to window based operating systems which have considerably enhanced ATM functionality and user interfaces.

Yingxu (2010) studied the formal design model of the ATM system, the study included ATM design specification using denotation mathematics known as Real Time Process Algebra (RTPA). Using RTPA architectural modeling methodology, the architecture of the ATM system was built and refined by some set of unified data models (UDMs) which share a generic mathematical models of tuples, the static behavior of the ATM system is specified and refined by a set of Unified Process Models (UPMs) for the system transition processing and some supporting processes. Based on this ATM design model; formal design model, codes can be generated automatically using Real Time Process Algebra Code Generator (RTPA-CG) or be seamlessly transformed into programs by the programmer.

Sultan (2009) carried out a study on the impact of ATM on customers’ satisfaction, the study was comparatively done using three major banks in India. The study used a sample 360 of respondents equally representing each bank obtained from questionnaire and interviews; it used statistical tools to compile the results. The result shows that material satisfaction level depends on the size of the respective bank and the number of years of its establishment.

Fabumni (2011) worked on the appraisal of the use of ATM in the banking industry in Nigeria. It involves the use of diffusion innovation model, questionnaires were used to collect data in order to get the required information from the users and non users of the system and the result of the hypothesis were stated at the end of the analysis. From the results, it could definitively be said that the relative advantage of using ATMs; how hard it was to use ATMs, how compatible ATMs were with the lifestyle of the users; how much has been registered (observed) about ATMs by the users and whether ATMs could be tested before consistent use, were issues that influence users’ attitude towards intention to use ATMs.

Rimvydas, et al (2007), present approach to the optimization of cash management for Automated Teller Machine network, the approach is based on artificial neural network to forecast a daily cash demand for every ATMs in the network and on the optimization procedure to estimate the optimal cash load for every ATM. The optimization procedure considered important factors for ATM maintenance; cost of cash, cost of cash uploading and cost of daily services. The simulation of the ATM network’s cash-management optimization system showed good results, but for practical implementation of the proposed system further experimental investigations are necessary.

Heli (2006) discussed the ATM network market structure and cash usage, the aim was to construct the ATM equation. The monopolisation of ATM network market structure and its effects on the number of ATMs and on cash in circulation were analysed both theoretically and empirically. The unique annual data set on 20 countries used in the estimations has been combined from various data sources. The observation period is 1988–2003, but the data on some countries are available only for a shorter period. Based on the
studies theoretical discussion, as well as the estimation results, monopolisation of the ATM network market structure is associated with a smaller number of ATMs.

Richa, et al (2012) investigated the customer attitude towards the ATM of SBI and ICICI bank in India. This study aims at comparing the attitude of people towards ATM of SBI and ICICI banks. It also aims at finding out the factors influencing the use of ATM. It also outlines the problems usually faced by customers while using ATM of their banks. Target group chosen for this study were the people who have account in SBI and ICICI bank in Sirsa City (Haryana, India) and who are using the facility of ATM. This study reveals that on some point there is a difference in attitude of customer of ICICI and SBI bank towards ATM services. It reveals that most important factor which influence customer to use the ATM services is its convenience in use case of both ICICI and SBI bank. Easy availability of machines also affects its use. Customer also uses ATM of ICICI because they agree that its use is secured. The main problem from ICICI ATM is that its machine most at times goes out of cash. It also revealed that the use of ATM is highly increasing.

3. SYSTEM ANALYSIS AND DESIGN

System analysis is a process of carrying out a detailed study in an organized way of doing things with the aim of gaining a thorough understanding of that system. The architectural design of this system is shown in figure 1 and Object Oriented Analysis and Design Methodology (OOAD) used as design methodology is illustrated using class diagram in figure 2.

3.1 Architectural Design of the ATM Emulator

![ATM Emulator Diagram]

Figure 1: Architectural Design of the ATM Emulator

Authentication: This ensures the security of the ATM customer’s data, it uses the account number and PIN number to achieve this. A customer has to enter his account number and PIN, which are verified in order to give the customer access to the system.

Transactions: these include inquiry, withdrawal, statement, recharge, deposit, transfer, and change pin, any of these transactions can be performed by the user after he has been authenticated by the system.

3.2 Object Oriented Analysis and Design Methodology (OOAD)

OOADM is a software engineering approach that models a system as a group of interacting objects, each object represents an entity of interest in the system being modeled, and is characterized by its class, data element and its behavior. The design tool used in this work is Unified Modeling Language (UML) because it is a graphical language for modeling software. UML is a set of diagrams used to specify, construct, visualize, and document software design. The UML diagrams used in this software are USE CASE, CLASS and
ACTIVITY diagrams but only the class diagram will be presented in this work as shown in figure 2.

Class Diagram
The class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing and documenting different aspects of a system but also for constructing executable code of the software application. This class diagram describes the classes and attributes in ATM operations. The class diagrams are widely used in the modeling object oriented systems because they are the only UML diagrams which can be mapped directly with object oriented languages.

![Class Diagram of the ATM System](image)

3.3 Database
This involves storing, processing and securing data. Designing a database entails producing a detailed data structure (model) for data collection.

MYSQL was used in this work for storing and easy manipulation of data. Some of the tables used include the following:
Table 1: Customer Account Table
4. SYSTEM IMPLEMENTATION

The system will work best on recent operating systems such as windows operating systems: A window 98 or higher version, Linux, etc.

The system was developed using the following:

i. Dreamweaver: this is for writing, edited, debugging and building HTML, CSS, PHP and javascript codes.

ii. Sql-yog : this is used in designing and re-editing MySQL database.

iii. Wamp server: this was used for running and detecting of PHP and MySQL errors.

The system was implemented using the following languages: HTML, CSS, PHP, MySQL, JAVASCRIPT.

4.1 Some Screenshots Demos
• **PIN number authentication interface.**
The ATM Emulator requests for customer’s PIN (personal identification number) through an interface as shown in figure 3. The system uses this PIN to compare with the account number supplied by the customer to check if the records correspond, this is a kind of security measure to ensure that account is only accessed by the right customer.

![Figure 3: PIN number authentication interface](image)

• **Transaction Interface**
This interface pop up as soon as the Emulator authenticates the customer, the customer can select a transaction to carry out by clicking on a particular option in the list as shown in figure 4.

![Figure 4: Transaction Interface](image)

• **Customer’s Balance Interface**
Figure 5 is displayed to the customer if he chooses to know his account balance (ie by clicking “Inquiry” on the transaction interface above), after this transaction, the customer can proceed to perform other transactions or terminate transaction and even print this receipt if he wishes.

![Figure 5: Customer’s Balance Interface](image)
5. CONCLUSION

From this study, it was shown that ATM is a term used to describe an electronic banking outlet, which allows customers to complete basic transactions without the aid of any bank official or teller. ATM Emulator is the ability of a computer program in an electronic device such as PC to imitate an ATM program.

The importance of ATM can never be overemphasize as hitherto, there is no bank service as convenient, effective and efficient as ATM. ATMs provide security to customers account since each customer has a personal identification number (PIN) that gives him access to his account, it also provide a faster and accurate means of maintaining records to banks. The study of ATM Emulator has been to design ATM software that will be able to work with ATM hardware and appropriate network by simulating the basic ATM transaction operations.

5.2 RECOMMENDATIONS

This study revealed that ATM faces a lot of security threats ranging from hardware, software to network security, therefore other study relating to ATM should be channeled to stronger security measure such as biometrics.

Currently none of the banking technologies offer all the services customers enjoy from their bank including ATMs, for instance, customers still need to visit banks to open an account, cash or pay cheques etc. the quest should be how to make ATM complete so as to render all services obtainable in the bank and should made available in strategic areas for efficient banking services.

Customers of banks usually experience intermittent network outage, stabilizing ATMs network should be of great concern for further studies.

REFERENCES