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AUTOMATED TELLER MACHINE MENU DESIGN COMPARATIVE ANALYSIS: A CASE STUDY OF SELECTED BANKS IN ABUJA, NIGERIA.

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Abstract **— This paper aims to examine existing bank Automated Teller Machine (ATM) client interface plan with case studies drawn from some selected Nigerian banks. The paper is based upon the exploration of ATM client interface plan. This paper gives a presentation expressing the points and targets of the paper. The paper explains how the ATM Simulator model project was designed. The outcomes are diagrammatized, broken down and correlations made, every menu configuration is then evaluated. This paper looks at some selected banks ATM interface navigation menus with a view of providing recommendations of a best of the best breed ATM menu.**

Keywords—**Automated Teller Machine, User Interface, Navigation Menu, Human Computer Interaction, Personal Identification Number (PIN).**

I. INTRODUCTION

The drive for this paper is to carefully examine existing ATM (Automated Teller Machine) configuration and afterward create a 'best-of-the-best' ATM navigation list of options framework. The current ATM frameworks will be investigated and an evaluation will be carried out on each of the selected bank ATM i.e. every bank has a distinctive ATM interfaces. After examining the diverse ATM menu system, a proposed 'best of the best' user interface will be created. This upgraded user interface ought to perform better than the existing ATM menu design.

II. AIMS AND OBJECTIVES

The goal of this term paper is to critically study the problems users experience with the use of ATM Menu interface in order to design an interface that will eliminate or minimise this delay. This paper objective is to put forward a planned 'best-of-the-best' ATM client interface. To accomplish this objective, presently obtainable ATM designs involving some selected banks in Nigeria will need to be critically examined. The five banks used as case studies are, UBA, First Bank, GT Bank, Zenith Bank, and EcoBank.

The objective will be accomplished by:

- Studying selected ATM navigation menu framework plan and design.

- Administering Questionnaire – which will be given to ATM clients seen needing to embed their debit/credit cards into the Teller Machine more than once.

- Collecting measurable data – The aggregate number of individuals utilizing an Automated Teller Machine at a specified time period will be watched and proper recording will be documented. Data about the number of clients who needs to put their ATM card into the machine more than once will likewise be gathered, a percentage to be calculated and all the information and Figures accumulated will be presented in graphical form.

III. LITERATURE REVIEW

The acronym ATM in full means Automated Teller Machine or Automatic Teller Machine or a Cash Dispensing Machine (CDM) among other names. The Automatic Teller Machine is an electronic computer-based system that allows banks customers to use a protected and safe method carry out financial transaction or access their bank account. The ATM dispenses cash and allow customers to deposit. It also offer other cash related services like checking account balance and changing of PIN and payment of bills.

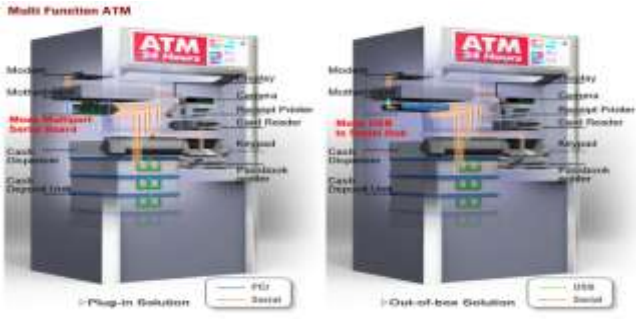

Fig. 1: Automated Teller Machine (ATM)

An ATM is operated when a bank card (credit or debit card) is inserted into the card recognition space. The details of the customer's account number and PIN (Personal Identification

Number) are stored on the cards magnetic stripe or chip. Fig. 1 shows an annotated ATM and what an ATM looks like pictorially.

A. Future ATM Technologies

Companies producing ATMs have identified several alternative technologies which have not received global acceptance.

These include:

- The use of multimodal Biometrics to enhance security check i.e. the approval of cash or service transactions based on automatic input from combination of the iris, fingerprints, the eye or facial patters etc.
- Individuals or corporate bodies advertising their goods and/or services on the ATM.
- Ability to display and get print outs of receipts for bill payment

The future and the next big innovation in the ATM industry are some of the examples that are listed above. However, financial institutions in the banking sector and manufacturers of ATM have to determine if these developments are workable and explore ways of finding out if customers will react positively to the intended change.

B. Problems with ATM Interface Design

The usefulness of ATM in terms of the service delivery it offers bank customers cannot be under estimated. However often times due to poor user interface design, ATM use can be a source of worry considering the length of time it takes to dispense. The interface enables the user to communicate with the machine. Therefore good user interface design is very important for high rate of use by bank customers. Listed below are some of the frequent challenges or inconveniences experienced when using an ATM.

Some of these problems include:

- The queuing time at the ATM station. If a user in front of you experience challenges in using the ATM due to poor user interface design, this will increase the waiting time of others in the queue.
- At the point when you finally get to use the ATM after the long wait, the ATM runs out of money and is unable to dispense cash.
- Poorly located ATM affects the ability of the user to view the contents of the ATM Menu. Some ATM are installed in areas where sunlight affects visibility.
- New ATM users also increases other users waiting time because of their inability to insert their card properly and their level of ATM use awareness.
  Certain Cash Dispensing Machine's may not provide the user with the exact amount of money they want on the initial cash withdrawal screen. The customer will be compelled to input the required amount by pressing the numeric keypad on the ATM. (e.g. to withdraw ₦2000 the user might have to pick 'other amounts' option on the screen menu before keying in '2000' using the keypad and then press the 'enter' key). At other times the Cash Machine will eject the card once the user's cash is dispensed. However the user may want to do carry out further transactions such as check balance or top-up a mobile phone). This will lead to the customer having to re-insert their ATM card, further increasing their time spent at the ATM.
- The arrangement of the menu options on some machines are not properly aligned with the corresponding keys thereby causing confusion and delay for users when using the machine.

C. Human Computer Interaction

According to Pat Heathcote, "Well designed systems can improve the output of employees, improve the quality of life and make the world a safer and more enjoyable place to live in!!!" A good interface design can help to ensure that users carry out task when the using the system:

- Security – this is vital for software systems that are used for missions with safety-consciousness as the principal objective; such as system for a jumbo jet.
- Efficiently – this is the main highlight of this paper and the point it addresses. ATM usability will increase and the delay time will drastically reduce if the ATM navigation menu design were improved upon. This would enable ATM use to be more efficient. For example ATM users would not like to spend 10 minutes trying to figure out the proper way to insert their card and key in their Personal Identification Number and the amount they want to withdraw and the leave the machine without removing their cash card.
- Pleasurably – systems should be attractive and inviting. Usually if a system is effective and efficient to utilize, it should also be pleasurable to use as a result. However extra work could be done to make ATM navigation interface design more pleasurable to use for example making the monitor screens and menu items more colourful and have pictures.

Generally speaking, the more usage a bank's ATM gets, the more prospect there is for the bank to terms of profit margin. Consequently the importance of a good ATM interface design cannot be over emphasized for those in the banking industry.

IV. STATEMENT OF THE PROBLEM

The invention and use of the ATM has changed the way we access our funds and pay for certain services. It is a machine that has become a necessary and vital part of our everyday existence. Simply put, we would struggle to live without it. As important as the service that the machine renders, it is very frustrating that there are times that the one has to wait for a long time on the queue to use the machine. Why are situations like this very common in many ATM terminals? There must be a system design fault in the user navigation interface. Hence there is a need to explore and design new user interface that will be user friendly and will save the amount of time people spend queuing to use the machine. It is

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obvious that the present ATM user navigation screen interface design could be improved upon considerably.

V. METHODOLOGY

The fact finding method that will be employed to collect relevant information for the planned 'best-of-the-best' ATM navigation menu system are the use of questionnaires and observation.

Observation for this research will be done in two ways:

- Members of the public were observed using ATM's of the selected banks. The time it takes for observed number of users will be recorded, along with their gender and age range.
- Those users that were observed inserting their card more than once will then be approached and asked why they had to input their card more than once. The answer they provide will help to identify the problems with some ATM's.

All information will be noted and recorded and the appropriate statistical analysis will be carried out.

The hardware requirements to model the present ATM's (for evaluation use) and the planned ATM model is a laptop computer. Also required is a digital stopwatch to record results.

The software requirement to create a model for the present systems ATM's and the planned ATM system is:

- Microsoft Windows Operating System 8
- Microsoft .NET Framework SDK v6.0
- Microsoft Visual Studio 2013

The ATM performance reports will be entered into Microsoft Excel and program will also be used to record the ATM performance outcomes from the experiments carried out and to generate graphical representations of this data.

A test environment location will be used to evaluate the performance of the existing ATM navigation menu system after these systems have been mapped out and implemented. This will help determine what features from the current ATM's will be incorporated into the proposed 'best-of-the-best' ATM menu system.

D. ATM System Design

A program was generated to measure the ability of the selected banks ATM to carry out financial transaction. The real operation of each banks ATM was simulated using the created. Testing and monitoring are then carried out on ATM's to check their performance.

Fig. 2 illustrates how the system is designed is operated.
A customer is presented with a set of action buttons. The customer will click on the desired button, which will then the user to the specified banks ATM simulator.

Selections from the menu items is carried out by from the eight keys on either side of the ATM screen.

The 'Insert Card' button will be used to simulate the user inserting the ATM card into the ATM. The keypad containing the digits 0-9 and the keys 'Cancel', 'Clear' and 'Enter' is standard for all the various types of ATMs investigated in this research. The button 'Back to Main Menu' is simply to take the user back to the main screen illustrated in Fig. 2.

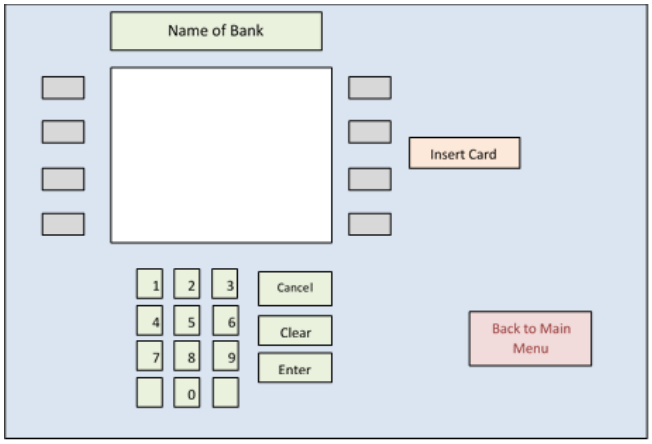

Fig. 2: ATM Simulator Interface Design

The 'best-of-the-best' ATM navigation menu system (called BestATM. which means optimal ATM menu) also uses the standard interface shown in Fig. 2.

Based on the system model designed, transaction performance testing is carried out on the existing ATM navigation menu interface as well as that of the BestATM. The working function of the ATM simulator will not simulate the time it takes for data to be read off the card and the time it takes for the bank to be contacted. This processing times only occur in real life scenarios of ATM usage. As these processing handling time periods will not be represented by any of the ATM simulations, the transaction performance test results will be accurate as they are all relative.

Other significant elements to be aware of are; several inconveniences can arise when using an ATM, such as – there is no cash in the machine, customers PIN is not correctly entered, card reading error, etc. These scenarios will not be available with the ATM Simulator. The ATM Simulator has a home page screen that allow end user to click which ATM to simulate. With the use of ATM simulator, 'perfect' transactions will be simulated i.e. no card reader errors will be detected, the PIN entered will always be accurate and there is plenty of fund in the card. This is demonstrated in Fig. 3. Buttons are used to represent the banks logo. To simulate a specific bank the user will click on a bank button. All the buttons take the user to all the present ATM simulations.

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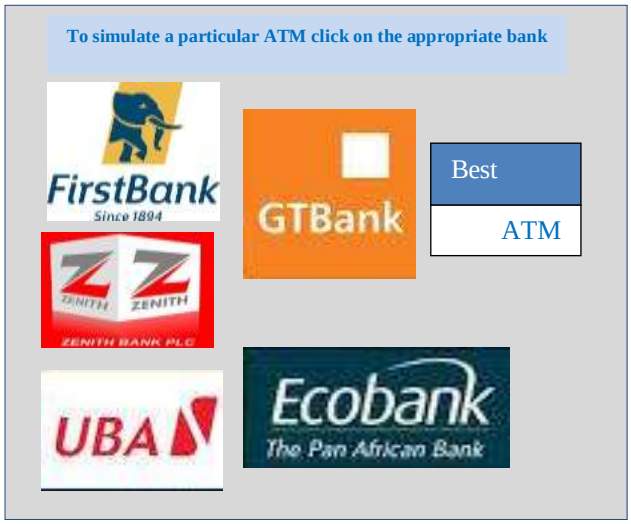

Fig. 3: ATM Simulator Main Screen

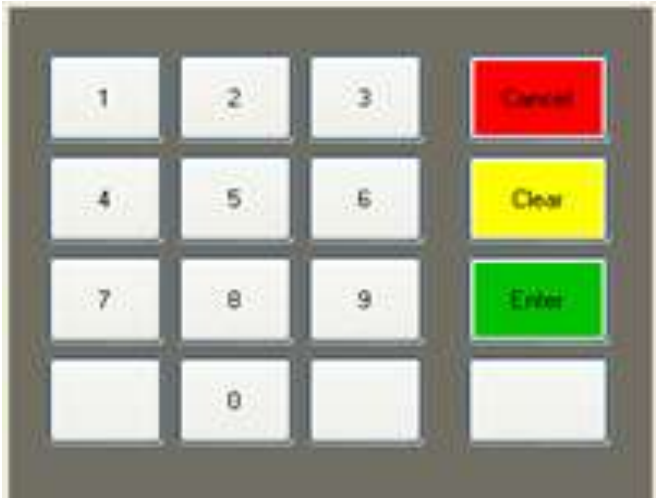

Fig. 4: ATM keypad

It is not possible to physically insert an ATM card when using the ATM Simulator. Therefore an 'insert card' button has been created to simulate inserting the card into the ATM. When the user click this button, the screen showing the next menu item will appear. This screen will ask the user to key in PIN. The ATM Simulator were simply used to simulate the use of an ATM. An ATM simulator is a tool to allow transaction performance time and cannot be used to verify that the PIN entered is correct. To key in the PIN, the user would have to click on the four digits on the numeric keypad displayed in Fig. 4. Once this number is clicked, it triggers an action which takes the user to the next screen.

For choice menu, the user just simply needs to click on the suitable key adjacent to the menu option as seen on the screen. This action is similar to a real life use of an ATM where the user presses the acceptable key on the keypad.

ATM users will be presented with different withdrawal options when they the user click on the button designated for the withdrawal of cash.

E. BestATM

Over a period of days, we observed customers using the ATMs. The number of users that were seen re-inserting their ATM cards was recorded against the total number of users seen using the ATM.

Table I: ATM Customers observed reinserting card

ATM	Total number observed using ATM	Total number observed reinserting card	% of reinserted cards
UBA	31	6	6.45
First Bank	64	5	7.81
GT Bank	37	2	5.41
Zenith Bank	44	4	9.09
EcoBank	35	7	8.57

The data in Table I is graphical represented in Fig. 9. This data may indicate that Zenith Bank has the higher usability issues while GT Bank has the least. However, many factors have to be considered when analysing this data. If the ATM observations were carried out again the results could be a lot different. The main factor which will affect these results is:

The individuals who use the ATM when the observations are made i.e. are the customers novice, intermediate or expert users. These levels of expertise may be determined by the age of the user for example.

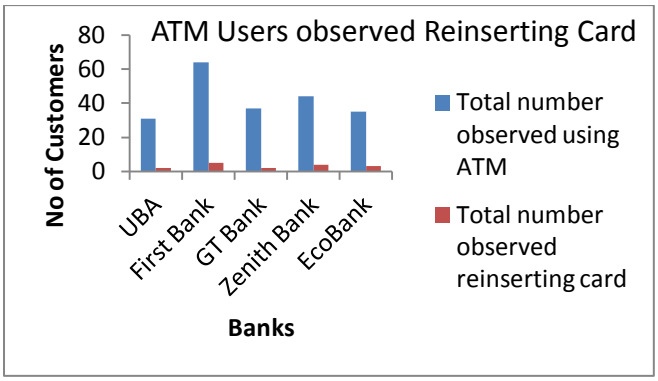

Fig. 5: ATM users observed reinserting card

The data in Table 1 and Fig. 5 may be described as insignificant for analytical purposes. However, it still provides an insight into the problems of ATM user interface issues. The data collected reinforces the fact that users regularly have to reinsert their ATM cards to carry out further transactions. It was found out that the main reason why bank customers use an ATM was to withdraw money. This may seem obvious but it was important to make this assumption concrete. Out of the 211 ATM users observed (covering the 5 banks), 200 users said that the main reason why they use an ATM is to simply withdraw cash. The remaining 11 ATM users said they mainly used an ATM to check their bank account balance. This data is illustrated in Fig. 6.

However, these ATM customers also said that they usually follow up this initial transaction with an additional transaction of withdrawing cash.

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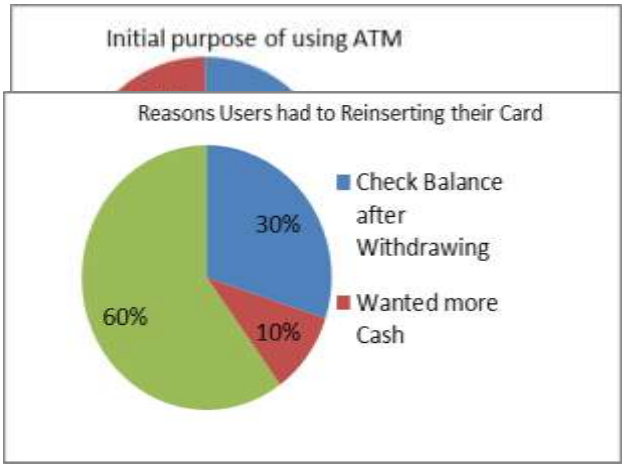

Fig. 6: Main purposes of using an ATM

Fig. 7: Reasons Users had to reinsert Card

Fig. 7 data as shown above will be relevant when creating the menu system for the BestATM. The graph shows that another problem that ATM card users face in carrying out transaction is the fact that they have to re-insert their card each time they want to carry out a transaction. Fig.7. also shows the reason customers gave for reinserting their ATM cards.
More was done in creating the new system. Just observing present ATM users and questioning them did not provide all the necessary information needed to help create the planned ATM.

As discussed in an earlier sections of this paper, each ATMs (i.e. UBA, First Bank, GTBank, Zenith Bank, and EcoBank) navigation menu system were represented and implemented to create the ATM Simulation model. Every ATM performance was tested by four independent different users and an average of the times was recorded. The different performance tests were to (1) Withdraw ₦1000 (a standard amount presented to customer); (2) Withdraw ₦1000 with receipt; (3) Withdraw ₦3000 (another amount); (4) Withdraw ₦3000 with receipt; (5) Check Balance on screen; (6) Print Balance and (7) Check balance and then withdraw ₦1000. The range of usability of this standard ATM was a great indicator of every Banks ATM card that was tested.

So as to ascertain the ATM that perform optimally, a series of transaction testing was done on each of them. The associated report from each was entered into the BestATM as it contains all the optimal capabilities of present ATMs and none of the poorly performing features. Fig. 8 shows the average time every ATM took to withdraw ₦1000. This amount was selected as a standard because all ATM allows this monetary value for customers on their menu list.

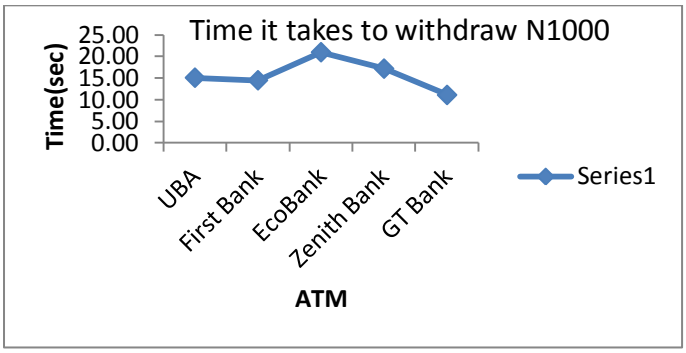

Fig. 8: Times it takes to withdraw N1000

Fig. 12, shows GT Bank ATM having the quickest cash withdrawal time. This can be attributed to the fact that once the user enters their PIN, they are automatically given the option to withdraw cash without the need of any further operation. UBA, Zenith Bank, and EcoBank ATMs are all relatively close in performance times with First Bank surpassing them. EcoBank has the worst transaction time. This is due to EcoBank giving the user a lot of information and additional prompts like language options. Ideally the 'Best-of-the-best' BestATM will have GT Bank cash withdrawal feature built into its menu design.

Due to lack of space, all possible scenario cannot be described in this report. The five ATMs were evaluated and the results were used to stimulate the 'Best-of-the-best' BestATM. BestATM should include the useful capabilities from the ATMs which yield the fastest and most efficient results for each cash transaction. Ideally the BestATM would have all the best features of the banks

The BestATM should perform better than current ATMs however; The 'Best-of-the-best' BestATM should provide the user with options like 'Do you want another transaction?' when the user wants to withdraw cash, but at the same time overcome the problem of making sure that user's cannot depart without taking their ATM card with them. There are some ATMs which operate differently from the ones investigated here.

ATMs work in a different manner in that (1) User inserts their card; (2) Card is read and the user is instructed to remove card and (3) User enters PIN and carries out transaction/s needed.

Fig. 9: BestATM Navigation User Interface

Fig. 9 depicts the menu options displayed to the customer after the PIN is keyed in. The BestATM primary menu screen is an integration of all the main user options. Transaction time

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is greatly reduced with this model. After every withdrawal of cash, users are always asked the question 'Would you like another transaction?' To test whether BestATM is a 'best-of-the-best' the ATM navigation menu design is put to test against the other ATMs under review. This is depicted in Fig. 10.

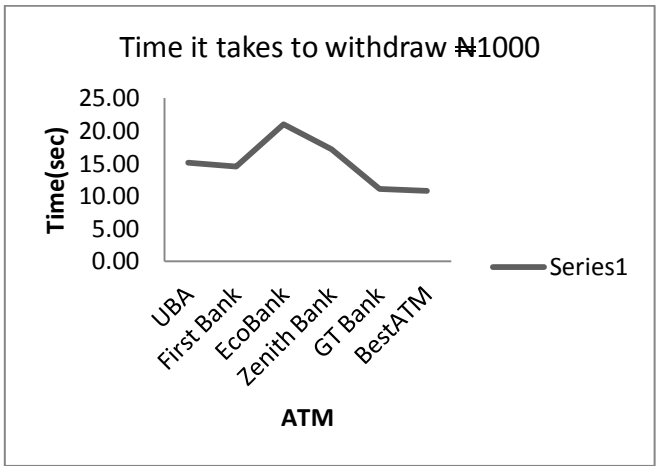

Fig. 10: Comparing BestATM - Withdraw ₦1000

Fig. 10 demonstrates that the BestATM is observed to be slightly slower in terms of the time it takes to withdraw ₦1000 than the GTBank card. The observed delay in time is as a result of user removing their cards before beginning their transaction operation. On a positive note and considering the above stated reason, BestATM still performs better when compared to the others.

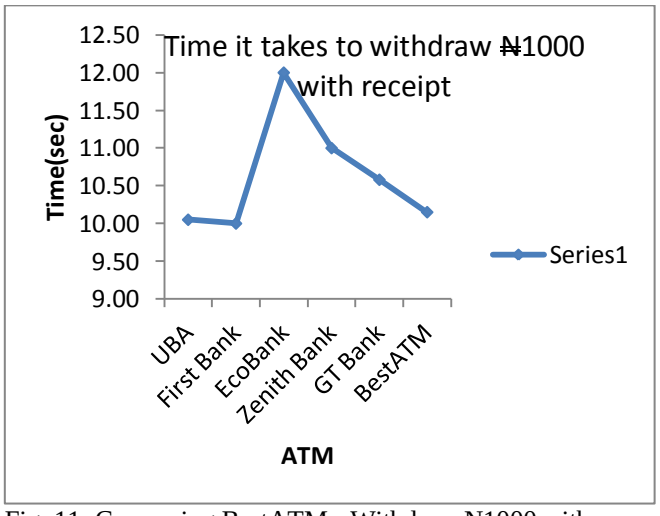

Fig. 11: Comparing BestATM - Withdraw ₦1000 with receipt

Fig. 11 shows that the BestATM is slightly slower at completing this transaction. This is due to the fact that the user has to remove the ATM card before continuing with the transaction. Therefore this is an acceptable result. The benefits of the added facility allowing the user to carry out another transaction after withdrawing cash, outweighs the fact that the BestATM is out performed by both UBA and the First Bank.

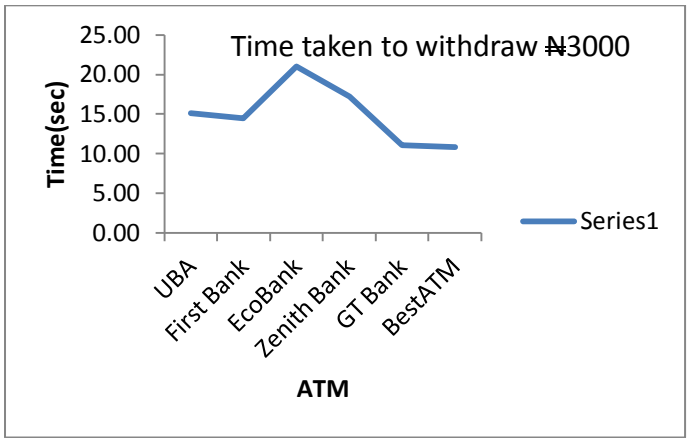

Fig. 12: Comparing BestATM - Withdraw ₦3000

Fig. 12 Illustrates that the BestATM model can extract N3000 i.e. other denomination of cash at a good time as compared to the other ATMs under investigation.

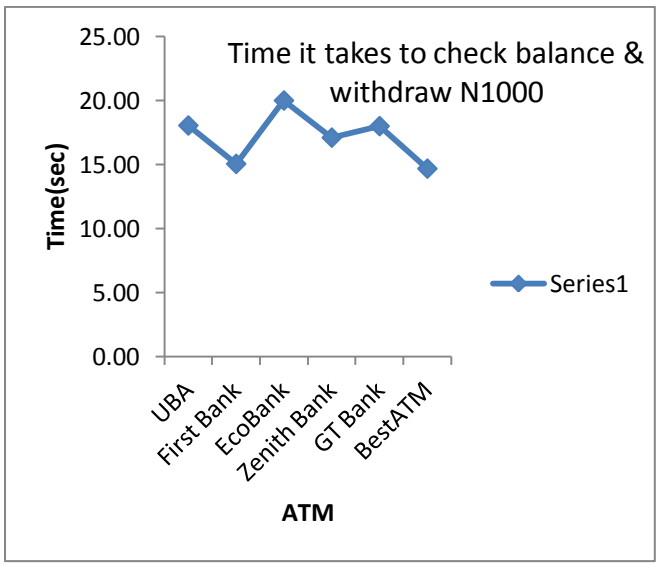

Fig. 13: Comparing BestATM – Check balance & withdraw N1000

Fig. 13 prove that the BestATM model yields the quickest time to check account balance and withdrawal of ₦1000 made. BestATM is an upgrade of the tested real world ATM systems. Out of a total seven transaction performance attempt, the BestATM did not record the fastest time on only two occasions.

Fig. 14 shows that the BestATM design was slightly beaten in two tests, it still has an overall better performance than the best performing existing ATM system.

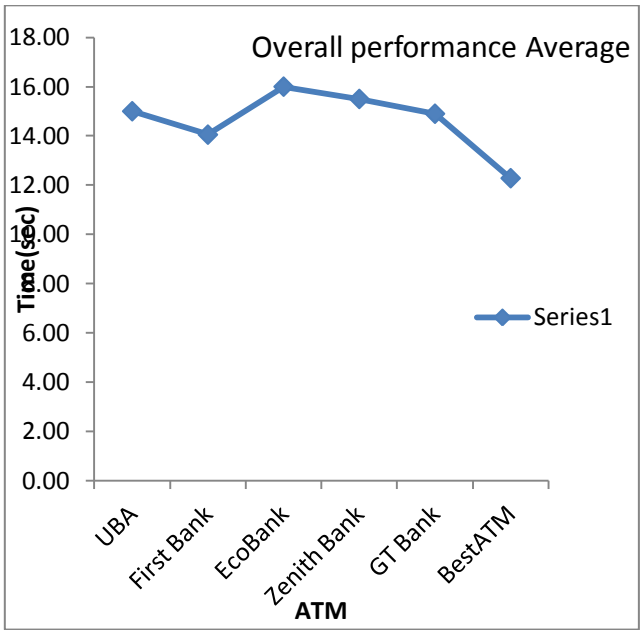

Fig. 14: Average of overall transaction times for each ATM system

The fact that the BestATM design has the added facility of eliminating the need to reinsert ATM cards, while at the same time improving overall performance, reinforces that the BestATM navigation menu design is an improved 'best-of-breed' ATM navigation menu system.

VI. CONCLUSION

The key objective was to produce a 'best-of-the-best' ATM user interface with easy to use navigation menu system. This was realized by creating a model called the BestATM. As proven, the BestATM navigation menu design, performed better and it is more operational and time saving than the other ATMs examined. The BestATM system was created to resolve the challenge of customer's difficult experience of having to reinsert their ATM cash cards in other to carry out more transaction and to quicken transaction times. Bank customer's everyday transaction could be greatly improve by the use of this model. Many cutting-edge technological advance ATM machines offer plenty additional services including ability to pay for utility bills, cash and cheque deposits, top-up airtime on pay as you go mobile phone and buying reservation tickets for online flight booking. ATMs are here to stay and they have become a necessary part of our today's world. However, as the services obtainable on the ATM platform grow, the ATM navigational menu designs will become more complex. This positive development may come with its associated disadvantage because it may mean that systems may even become more confusing for users. The recommendation is that ATM manufacturers should consult widely with ATM users to aid them scheme and create easy-to-use and efficient and effective ATM user interface navigation systems.

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