

Simulation Model of an Innovative Talking ATM for Blind Users in Nigerian Banking Sector

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Abstract

An Automated Teller Machine (ATM) is an electronic telecommunications device that enables customers of financial institutions to perform financial transactions, such as cash withdrawals, deposits, funds transfers, balance inquiries or account information inquiries. Over time, consumers have come to depend on and trust the Automatic Teller Machine (ATM) to conveniently meet their banking needs most especially for blind users in Nigeria. In this paper a Simulation Model of An Innovative Talking ATM for Blind Users in Nigerian Banking Sector was developed to provides audible instructions so that persons who cannot read an ATM screen can independently use the machine. The Simulating model is a talking ATM that provide the ability to conduct transactions using both visual and auditory components. A talking ATM will provide a means of persons with visual impairments to utilize the ATM by making use of audible instructions. Many ATMs today include an audio component that makes use of a speaker system, the Simulating and Modelling a talking ATM employs the feature of a headphone jack or telephone handset that allows the user to conduct the transaction with a degree of security. The designed model enhance the Quality of Service provided to blind users from bank as it will reduces risk of being defrauded easily as blind users usually fall victim of fraud. Finally, this paper implements the solution for the blind users to make use of ATM independently without the help of anybody as they easily defrauded by bank staff or other individuals at the ATM point.

Keywords: *QoS, Talking ATM, Fund Transfer, Deposit and Withdrawal*

1. Introduction

An Automated Teller Machine (ATM) is a self-service device that can be used to distribute cash and do various individual teller functions, such as checking the balance, paying bills, printing or reading mini statements, and more. Debit and credit cards are used to conduct Automated Teller Machine (ATM) transactions, enabling cardholders to access and conduct financial transactions without the assistance of a teller. Almost all adults have used an automated teller machine (ATM), most likely without giving it much consideration as to who operates it or how. Financial organizations often house numerous ATMs (Avery, 2024).

ATMs are located not only on or near the premises of financial institutions, but also in locations like retail centers, airports, food markets, gas stations, dining establishments, and any other location that attracts a wide range of people. These people typically provide the Automated Teller Machine (ATM) as a convenience for their clientele, including those who are not customers. Although many are operated by independent businesses that operate ATMs for profit, these corporations and companies offer access to a range of transactions, including money distributions, exchanges, and remains, after Automated Teller Machines (ATMs) are also referred to as computerized financial devices, money devices, and numerous local variations depending on images of ATM systems organized by certain financial organizations. According to (Avery, 2024).

Every ATM requires the user to insert either a plastic smart card with a chip that holds a unique card number and security information such as an expiration date or CVVC (CVV) to identify themselves. The user enters a personal identification number (PIN) to provide authentication. Through ATMs, "customers can purchase pre-paid cell phone credit and view their banking records to assist with money distribution, charge cards for payday advances, and check their consideration levels." ATM deployment by financial organizations has risen to prominence (Baker, 2022).

Banks have recently been using ATMs more frequently in Nigeria, where their deployment is still relatively new. This has occurred particularly in the wake of the recent bank mergers, which most likely enabled more banks to raise the capital necessary to install ATMs or at the very least join shared networks. Technological relevance is a significant issue because of the banking industry's growing ATM deployment. Nigeria has been using ATM services for less than a decade. Initially, they functioned as exclusive services meant for individuals seeking special treatment (Mittal, 2021).

The introduction of Automated Teller Machines (ATMs) improved the financial landscape in Nigeria by reducing long lineups at banking locations as more and more clients chose to use them. However, the clients of the same financial institutions who were harmed creatively and blindly did not experience an increase in this relief. This uncomfortable circumstance prompted the creation of an Automated Teller Machine (ATM) designed specifically for financial institutions' blind clients. An automated teller machine (ATM) that offers reasonable instructions so that those who are blind or visually impaired can operate the machine on their own is known as a Discussing ATM (Bradley and Millsbaugh, 2018).

Although it is not a simple procedure, accessing the funds stored in a bank at any time is now rather easy. To obtain an ATM card, one should only inform his bank of his desire. He receives a passcode-protected ATM card from the bank that he can use alone. An ATM card can also be referred to as a bank card, cash card, key card, client card, or MAC (Money Access Card). Debit and credit cards can typically be used as well (Chakravorti, 2022).

Using a plastic smartcard with a chip or an ATM card with a magnetic stripe helps the customer be recognized. The consumer provides security by inputting a personal identification number (PIN). Now, it is simple for the person to get the money he needs for an outing or when he wants it to go shopping with his family. In the event that someone becomes extremely sick, they may also withdraw the money in the middle of the night. The ATM machine helps the customer to make his / her life much easier. It does most. The ATM card is slowly replacing cheque, the personal attendance of various customers, has increased banking hours and reduced the holidays. They do not require any paper-based verification (Chakravorti, 2022).

ATMs have grown to perform a wide range of other bank-related tasks, despite their initial development as simple cash dispensers. Certain countries, particularly those that have access to a completely integrated cross-bank ATM network, use ATMs for any purpose other than managing personal finances. These include paying regular bills, fees, and taxes (such as utilities, phone bills, social security, legal fees, taxes, etc.); printing bank statements; updating passbooks; loading money onto stored value cards; and making purchases, among other things. According to studies, banks actively promote the usage of ATM cards and find great financial benefit from providing ATM services (Deng et al., 2023).

According to Elmasri (2020), Due to the increased amount of non-bank customers, they draw—who must pay service fees—off-bank ATMs are typically more profitable for banks. Sadly, users of off-premise ATMs are more susceptible to robbery—blind users particularly so. Banking associations periodically survey banks, from which estimates of ATM robberies are obtained. One ATM crime (including robbery) was thought to occur for every 3.5 million transactions, based on those inquiries.

Developing their Information Technology (IT) infrastructure would undoubtedly play a major role in Nigerian banks' ability to please and keep clients in the current post-consolidation age. Nigerian banks have heavily invested in technology and extensively embraced electronic and communications networks to offer a wide range of value-added goods and services in an effort to keep up with global advancements and enhance the caliber of their service delivery (Laudon 2018).

In this paper a new Simulation Model of an Innovative Talking ATM for Blind users in Nigerian Banking sector will be developed to provides audible instructions so that persons who cannot read an ATM screen can independently use the machine. The Simulating model is a talking ATM that provide the ability to conduct transactions using both visual and auditory components. Essentially, a talking ATM will provide a means of persons with visual impairments to utilize the ATM by making use of audible instructions. While many ATMs today include an audio component that makes use of a speaker system, the propose Simulation Model employs the feature of a headphone jack or telephone handset that allows the user to conduct the transaction with a degree of security. The designed model enhance the Quality of Service provided to blind users from bank as it will reduces risk of being defrauded easily as blind users usually fall victim of fraud. The research outcome of this paper will provide fully function, succour, comfort and secured Talking Automated Teller Machine (ATM) with voice assistant for blind users. The design will bring a robust and friendly user interface Talking ATM system that will be use by blind users with little or no assistant from bank staff. This will provide various options through which the implemented system can be modified easily to meet the customer's satisfaction finally the new system will be use to evaluate the performance improvement of the new ATM systems.

2. Related Works

The Union Bank of India introduced a "Truly accessible talking ATM" on June 6, 2012, which enables blind individuals in India to conduct ATM transactions freely, whenever and wherever they choose, without the assistance of a third party according to figure 1 (Shellyand Rosenblatt, 2022).



Figure 1 Existing Talking – Union Bank of India

The Royal Bank of Canada unveiled the first voice ATM for the blind in history on October 22, 1997. Two concerned folks named Chris and Marie were the reason behind this voice ATM. As seen in figure 2, the Bank currently has a voice assistant-equipped ATM and a wheelchair available in every branch across Canada (Shellyand Rosenblatt, 2022).



Figure 2 Existing Talking – royal bank of Canada

The utilities include cash withdrawals made at the customer's convenience outside of the various branches' banking hours. In addition to offshore and off-peak service offering, there is a reduction in cost servicing. Having access makes it possible to offer a range of retail banking services to customers. They are usually found outside banks as well as airports, malls, and places far from the clients' home bank. ATMs were first intended to be cash dispensing machines, but with advancements in technology, they may now perform a number of functions, including money transfers between accounts, bill payment, and cash deposits. Banks typically use ATMs in the same manner as everyone else since it gives them a competitive edge (Baker, 2022).

According to Boeschoten (2023), ATMs are becoming more and more ubiquitous throughout the world for their various functions. One of the conveniences is that customers can withdraw cash at any time of day, instead of only during standard branch banking hours. Off-peak and offshore services are provided, and there is a drop in cost servicing. It is accessible and offers customers a variety of retail banking services. In addition to banks, other places where they might be found include shopping malls, airports, and other places far from the customers' home bank. ATMs can now perform a number of functions, including bill payment, cash deposits, and fund transfers between two accounts, despite their original purpose being to dispense cash. This is because of advancements in technology. Banks usually employ ATMs like any other to obtain a competitive edge.

Chakravorti (2023) examined ICICI Bank's customer satisfaction survey, concentrating on ATMs in the Udaipur area. Their investigation looked at several aspects, such as the quality of service provided by the employees, the location, the number of ATMs in the city, the frequency of operation, the impact these elements have on overall performance, and the options available to address several other pertinent issues. The study also explain that the quality of ATM services offered was somewhat above average, which translated into customers' satisfaction with the service being above average.

3. Materials and methodologies

Additionally, the hardware and software required to successfully construct a talking ATM for blind customers or users, as well as the functional and non-functional needs, were established clearly. Furthermore, this section provides a detailed explanation of the development environment, system testing, and implementation. The talking ATM interface is fully explained, along with the system and GUI implementations. The types and the test plan were discussed in addition to testing.

3.1 Proposed System

With the addition of a headphone jack, telephone, and Face ID/Voice recognition for login, the proposed talking ATM system model for blind users will have all the features of the current models. This will enable the blind population in Nigeria to conduct ATM transactions discreetly and independently without the assistance of a third party, as they are vulnerable to fraud at ATMs from bank employees and other private citizens. To further improve customer efficiency and ease of use, our system will no longer require ATM cards to access the machine; instead, users will be required to submit their registered account numbers and PIN, which will be issued by the bank. Furthermore, in comparison to the current system, this one will have higher security because blind users will be able to utilize it alone without aid from a third party. It is guaranteed that blind users will find the system easy to use even though they are blind and cannot see. The machine will respond to a blind user through a headphone jack, so only the person using the machine at that moment will know what response the machine is providing. In terms of security, however, the machine will provide options to users using numbers; even though it is intended for blind users, users can respond appropriately by using numbers 1 through 9.

The server manages the information stockpiling (database) and its entrance rationale (information layer) in this client-server architecture, while the client interface (presentation layer/rationale) may continue to run on either the client or the server, or it may even be split between the two. As shown in figure 3, a client is referred to as a fat or thick client if they control all or a large portion of the application rationales, and a slight client if they only control a small portion of the application rationales.

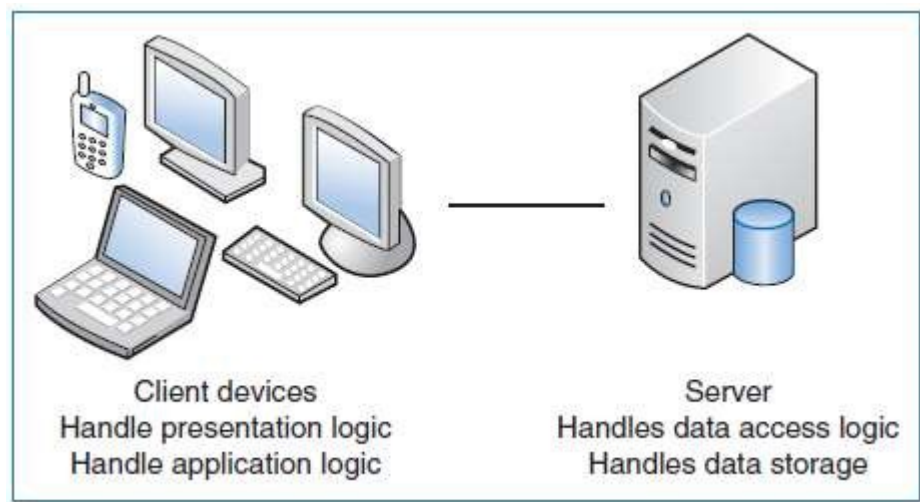


Figure 3 architecture of the Proposed Model

3.2 Hardware and software Requirements

According to Dennis et al. (2021), the primary components of any system are its hardware and software. These components are configured based on engineering blueprints and non-practical requirements. The specifics of the hardware and software will provide an illustration of what hardware and software are anticipated to support the system or application's operation.

3.2.1 Hardware

Hardware needed for operating ATM/talking provided in the table1 describe the process of hardware specified the functions of hardware with regard time, suggestions and descriptions.

Table 1 Hardware Specification

Hardware	Min	Suggestion	Descriptions
Internal Processor	Intel core i3	Intel core i7	this is to help the system in terms of speed and so on.
RAM	2GB	4GB	This helps in temporarily storage of data and making the system speed works perfect.
HD	120GB	500GB	This helps to store data permanently.
Monitor/screen	11 inch	15 inch	This helps to see perfectly and nicely.
Keyboard	Simple one	Complex qwerty eg	This will help to type in data in to the system.
Mouse	Good one	Laser mouse	This device will help in pointing menus and so on.
Hardware	Minimum	Suggested	Description
Processor	Intel Core 2 duo E4500 – 2.20GHz	Intel Core i7 990x – 3.46Ghz	This will help in effective use of memory and will reduce execution time, it’s the brain of computer. It’s responsible for processing.
RAM	1GB	3GB	This will help for temporary storing of data and will increase the system’s performance if used effectively
Hard drive	20GB	80GB	This will be used for storing data permanently also will be used for taking backups
Monitor	11” inch device monitor	15” inch LCD monitor or higher	This output device will be used for displaying data and/or output to users
Keyboard	Any suitable keyboard	QWERTY keyboard device	An input device which will be used for entering data into the computer
Mouse	Any suitable mouse	Laser mouse device	An input device which will be used to click and point on menus, icons and command buttons.

3.2.2 Software

Software that will help in developing talking ATM are Software needed for operating ATM/talking which provided in the table 2 describe the process of Software specified the functions of hardware with regard time, suggestions and descriptions.

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Table 2 Software Specification

Software	Min	Suggestion	Descriptions
OS	Windows	Latest Windows	This help to manage all the programs stored in a computer.
Software use to	JavaScript	JavaScript	This software will help to design and code the talking ATM.
DB	MongoDB	MongoDB	This will be used to store information regarding the talking ATM.
Suit	Ms Office	Ms Office	This will help in writing and typing documentation.
Tools	Umlet	SmartDraw	In order to design system design

4. CONFIGURATION, SETUP AND SIMULATION

With all of that in mind, the examination report from the directed survey and the discussions that help define the precise requirements for addressing ATM difficulties are conveyed in this part. Not only is prerequisite research an important component of any software project management, but usable requirements—which include the software system's utility—as well as non-utilitarian requirements, which focus more on the system's components, are also considered. Additionally, the final section provides information on the hardware and soft. A few more perspectives on the use of talking ATMs are also related to the improvement of environmental requirements, starting with the placement of the hardware and software needed to implement the system, the system architecture, and the accepted system design. Furthermore, various selection strategies were studied in order to assess the system's capabilities through discovery testing (substantial and invalid testing).


4.1 System Implementation and Testing

According to Shelly and Cashman et al. (2010), the implementation stage is the final, most expensive, and largest step of the SDLC. It is concerned with creating the actual system and ensuring that it operates as intended. Significant tasks including system development (programming), testing, and preparation ought to be completed during this stage. According to Dennis et al. (2010), the implementation chapter also includes the establishment process and bolster strategy, such as post implementation audit. This step includes constructing the backend system and figuring out the development environment. Furthermore, in this chapter, the writer/author will carry out the implementation process, which includes the enhancement environment for system development, the system's graphical user interface (GUI) with code for all functionalities, as well as the necessary assessment of hardware and software requirements to be used in the system's advancement and the security of the system's backend apparatus.

4.2 Black – box testing

This is testing strategy in which the analyzer have no information of inside structure working of the system and the source code of the system. Ordinarily, in performing this testing, the analyzer interface with the system GUI, pass any inputs and inspect the yields without having the information of where and how really the data is handled as described in table 4.


Tale 4. Deposit

Test ID	Description	Input	Expected Result	Actual Result
001	<p>Login</p> <p>Users must put valid account number and PIN to have full access to the system.</p>	<p>Empty fields:</p> <p>Account number</p> <p>PIN number</p>	System verifies user and give access	System authenticates user and give access.
				

4.3 Black – box testing – Valid testing for Deposit

This type of testing is generally carried out to verify the validity of the inputs and it focuses on the functioning of the systems; for this reason, it is sometimes referred to as functionality testing. The more advanced forms of testing, such as acceptance and system testing, are primarily important to discovery testing.

Tale 4. Valid testing for Deposit

Test ID	Description	Input	Expected Result	Actual Result
006	<p>Deposit</p> <p>Users must put valid account number and amount to deposit.</p>	<p>Empty fields:</p> <p>Account number</p> <p>Amount to deposit</p>	System will display transaction successfully	System checks and accept transaction.
				

4.2 Talking ATM Interface Explanation WELCOME PAGE

This welcome page provides users with easy access to their accounts and the ability to conduct any kind of transaction. It also features the project title, author, and system supervisor information. The system is user-friendly and simple to operate. Users will easily be able to use the system on their own without help from a third party as illustrate in figure 4.



Figure 4. Welcome Page

4.3. LOGIN PAGE

The option to choose which transaction to carry is provided on this page. Instead, if the user chooses ATM, they will need to enter their account number, password, and fingerprint authentication, as shown in figure 5. If, on the other hand, they choose deposit, they can complete their transaction without entering their password.



Figure 5. Login Page

4.4 ATM MAIN MENU

The user can choose which transactions, like fund transfers, PIN changes, withdrawals, and balance checks, to carry out on this page. After entering their credentials and undergoing authentication, users will have the ability to easily complete all of the transactions that are not on the list. As seen in figure 6., the selections are located in the ATM's main menu.



Figure 6. Main Menu

5. Conclusions

An Automated Teller Machine (ATM) is an electronic telecommunications device that enables customers of financial institutions to perform financial transactions, such as cash withdrawals, deposits, funds transfers, balance inquiries or account information inquiries. In this paper a Simulating and Modelling talking ATM was developed to provides audible instructions so that persons who cannot read an ATM screen can independently use the machine. All audible information is delivered privately through a standard headphone jack on the face of the machine or a separately attached telephone handset. Information is delivered to the customer either through pre-recorded sound files or via text-to-speech synthesis. Simulating and modelling a talking ATM provide the ability to conduct transactions using both visual and auditory components. Essentially, a talking ATM will provide a means of persons with visual impairments to utilize the ATM by making use of audible instructions. While many ATMs today include an audio component that makes use of a speaker system, the Simulating and Modelling a talking ATM employs the feature of a headphone jack or telephone handset that allows the user to conduct the transaction with a degree of security. The designed model enhance the Quality of Service provided to blind users from bank as it will reduces risk of being defrauded easily as blind users usually fall victim of fraud. Finally, the paper summarizes how ATMs have matured into a technology application providing financial services to all segments of our society, and the technical functionality behind the provisioning of those services. The hardware and software are given which elucidate about the hardware and software to be utilized as a part of creating an innovative talking ATM. The designed model enhance the Quality of Service provided to blind users from bank as it will reduces risk of being defrauded easily as blind users usually fall victim of fraud. Finally, the paper explain how ATMs have matured into a technology application providing financial services to all segments of our society, and the technical functionality behind the provisioning of those services. This paper implements the solution for the blind users to make use of ATM independently without the help of anybody as they easily defrauded by bank staff or other individuals at the ATM point as we identified the problems and solution.

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