AN AUTOMATED TELLER MACHINE (ATM) ENABLED PAYMENT OF POWER HOLDING COMPANY OF NIGERIA (PHCN) BILLS

by

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CERTIFICATION

This project title, "An Automated Teller Machine (ATM) Enabled Payment of Power Holding Company of Nigeria (PHCN) Bills" , by ADELEKE, Adegbola Blessing, meets the regulations governing the award of Postgraduate Diploma in Computer Science of Federal University of Technology, Minna.

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Mr R.O. Olayiwola Date

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DECLARATION

I, Adeleke, Adegbola Blessing; do hereby declare that this project work titled "An Automated Teller Machine (ATM) Enabled Payment of Power Holding Company of Nigeria (PHCN) Bills" was carried out by me under the supervision of Mr. R.O. Olayiwola, of the department of Mathematics and Computer Science, Federal University of Technology, Minna, Nigeria.

18-05-2010

ADELEKE A. BLESSING **DATE**

CERTIFICATION

This is to certify that this project work titled "An Automated Teller Machine (ATM) Enabled Payment of Power Holding Company of Nigeria (PHCN) Bills" by Adeleke, Adegbola Blessing with matriculation number: PGD/MCS/2007/1220 was carried out in the Department of Mathematics and Computer Science, Federal University of Technology, Minna, Nigeria.

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Mr. R. O. Olayiwola Date

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Prof. N.I. Akinwande Date

(Head of Department)

_____ _____

External Examiner Date

DEDICATION

This project work is dedicated to the Glory of God and my family.

ACKNOWLEDGEMENT

This project work like most research works is the brain child of the researcher, but the process of accomplishing it involves the contributions of many hands and minds. Of course many books and journals have been writing on the subject matter a long time ago. I therefore want to thank the Almighty God, the giver of life for His protection on me and my family in the course of my studies, having needed to travel most of the weekends to be in classes.

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ABSTRACT

Payment of utility bills, such as Power Holding Company of Nigeria (PHCN) bills is one of our day-to-day engagements. The use of an Automated Teller Machine (ATM) enabled payment system as an emerging and alternative mode of payment using a technology that is now commonly available is hereby promoted. This project presents An ATM Enabled Payment of Bills as a test case to prove the possibility of adoption of ATM technology for transactions other than normal cash withdrawal as it is being adopted in other part of the world. The project explored the development of an ATM enabled payment system, emphasizes the robust ATM architecture. The system was developed using Visual Basic 6.0 for the front-end and Microsoft Access for the back-end. The system runs on platforms such as personal computers and Operating System (Microsoft Windows XP, Vista and Windows 7). The result from the system indicated that payment of utility bills is possible, using ATM technology. It showed that ATM technology makes life easy and it makes payment of bills much more convenient.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The rapid and extensive development of information technologies has transformed the contemporary industrialized societies into a network of societies (Global Village). Information and Communication Technologies (ICT) is heavily promoting, improving, enhancing and sometimes dictating changes in business, economy, culture and the world at large. The Automated Teller Machine (ATM) is one of those ICTs technologies that have changed the way transactions are carried out in our modern and sophisticated world.

There is no contesting the fact that the introduction of ATM technology has changed the face of businesses and electronic transactions in Nigeria. This project hopes to appraise the advent of ATM driven payment with regard to the present and the future.

An Automated Teller Machine (ATM) is a safety-critical and real-time system that is highly complicated in design and implementation. An Automated teller machine or ATM allows a bank customer to conduct their banking transactions (Credit and Debit of accounts) from almost every other ATM machine in a particular country or around the world. As is often the case with inventions, many inventors contributed in the history of an invention, as it is the case with the ATM. Over the years the use of ATM as the means of transacting businesses including cash withdrawer and bills payment is now a reality of our time.

With ATM, you can access and carry out most of your personal banking transactions 24-hours a day, 365 days a year. With an ATM, you can perform a wide range of transactions through Automated Teller Machines (ATM) at any time that is convenient for you, day or night. The ability to quickly and easily complete a transaction can be a key to delivering a positive customer experience.

The emergence of e-commerce has created new financial needs that in many cases cannot be effectively fulfilled by the traditional manual payment systems. Recognizing this, virtually all interested parties are exploring various types of electronic payment system and issues surrounding electronic payment system and digital currency.

Conventional versus Electronic Payment System

To get into the depth of electronic payment process, it is better to understand the processing of conventional or traditional payment system. A conventional process of payment and settlement involves a buyer-to-seller transfer of cash or payment information. The actual settlement of payment takes place in the financial processing network. A cash payment requires a buyer's withdrawals from his/her bank account, a transfer of cash to the seller, and the seller's deposit of payment to his/her account. Non-cash payment mechanisms are settled by adjusting i.e. crediting and debiting the appropriate accounts between banks based on payment information conveyed via cheque, credit cards or the use of ATM.

An automated teller machine (ATM) is a data terminal with two input and four output devices.

Similar to many other data terminals, the ATM must connect and communicate through a host network and the internet in most cases. The host network may be compared to an Internet Service Provider (ISP) in that it is the gateway through which all the various ATM networks become available to the cardholders or customers.

The two input devices in an ATM are:

1. A card reader that captures information stored on the magnetic strip on the back of the ATM debit or credit card.
2. A keypad that allows the card holder to inform the bank of the required transaction (cash withdrawal, transfer of funds, balance inquiry, etc.) and the required amount.

The four output methods in an ATM are:

1. A speaker that provides the cardholder with audio feedback when a key is pressed.
2. A display screen that prompts the cardholder through each step of the transaction process.
3. A printer that provides the cardholder with a receipt.
4. A safe and cash dispensing mechanism. The cash dispensing mechanism contains an electric eye that counts each bill as it exits and provides a recorded log for transaction accuracy. To ensure that more than one bill is not dispensed, this mechanism also contains a sensor that measures the thickness of each bill. If two bills are stuck together or are excessively worn or torn, they are diverted into a reject bin for later retrieval at the time of machine maintenance.

Automated Teller Machine (ATM) is a computer. It has a small display and something similar to a keyboard (even if it doesn't look like one). It runs a program that is usually written by the banks or ATM Service Provider Companies. The program could do anything but banks usually follow a pattern. Most banks start by asking for the language. They then ask you to insert your card. This card has a magnetic strip on the back that it reads information about your bank account (sort of like a diskette on a PC). It uses this information to look up your information and decide what to do next. Usually this is to have you enter your password or Personal Identification Number (PIN). After that, it's up to the program to decide what to do next. As for the equipment, banks usually buy the ATM as a single piece but it is actually made up of components. There would be several PCI slots. Each PCI slot would have a specialized card to support the equipment. One slot would be used for the modem (or network interface card) so it can be managed from the main office and can obtain information it needs from the central computer (server) where most information is kept. Another slot would be for the card reader where you stick the ATM card in. The money dispenser is another. The deposit slot is part of the money dispenser. The display and keypad use the keyboard and display connectors.

Banking customers may access their accounts using a magnetically card (ATM debit or credit card). Generally the customer will insert their card into the machine, which will correlate the identifying information encoded on the card with a personal identification number provided by the customer. This verifies the customer's identity to the computer system which operates the machine. Thereafter the customer may typically use the ATM to conduct banking transactions as well as to check the status of various accounts

that they have with the financial institution. When all of the transactions and inquiries are completed, the customer will receive his card back from the machine along with one or more receipts documenting the transactions performed.

1.2 Statement of the Problem

Normal challenges facing individual, family and businesses in Nigeria include method of bills payment among other things. Many people failed to pay their bills as and when due primarily because of limited time and transportation problems, because Power Holding Company of Nigeria (PHCN) offices are not near in most places. And, often payment through the Banks is horrendous. At other times, there are complications arising from bulky paper works that accompany manual bills payment method.

1.3 Objective of the Study

1.3.1 General Objective

The purpose of the study was to develop software that delivers the function of an ATM enabled payment of bills to Power Holding Company of Nigeria (PHCN)

1.3.2 Specific Objectives

The specific objectives of this project work are:

i. To investigate and review existing methods of payment of bills to PHCN

ii. To review existing literature on Electronic payment system including ATM enabled payment system

iii. To identify requirement for the development of Automated Teller Machine (ATM) enabled payment

iv. To develop a prototype of Automated Teller Machine (ATM) enabled payment software for payment of electricity bills.

v. To test and validate the prototype developed against the requirement in (iii) above

1.4 The Scope of the Study

The project will only limit itself to the development of the software that will perform the functions of ATM for the purpose of making remote payment to Power Holding Company of Nigeria (PHCN) that will deliver convenience, effectiveness and time-saving platform

1.5 Significance of the Study

The significance of ATM cannot be over-stressed in our economy. The reality of a cashless society and globalization would soon affect the way businesses are transacted. The advent of ATM-oriented banking system has proven to be adding values to our lives in so many ways. In view of this study, the use of ATM as a means of payment system has the following advantages.

i. Since ATM machine is now an ubiquitous phenomenon , payment via ATM machine would eliminate distance barrier and transportation problems

ii. It creates convenience for the payee, as bills could be paid, even after the close of business and it makes payment a lot easier.

iii. With your ATM, you do not need to have cash or cheque before paying your bill once you have credit in your account that is linked with ATM card

iv. It improves the customer relationship

v. ATM machine is user's friendly and easy to use

1.6 Limitation of the Study

Due to infrastructure and licensing constraints, the program developed could not be linked to ATM Service Provider Companies and the Banking industry at the moment. This work limits itself to the software aspect of the Automated Teller Machine (ATM) enabled payment system. There is room for further research and development in this work.

CHAPTER TWO

LITERATURE REVIEW

2.1 The History of Automated Teller Machine (ATM)

A mechanical cash dispenser, arguably an ATM, was developed and built by Luther George Simjian and installed 1939 in New York by the City Bank of New York, but removed after 6 months due to the lack of customer acceptance.

Thereafter, the history of ATMs paused for over 25 years, until De La Rue developed the first electronic ATM, which was installed first in Enfield Town in North London on June 27, 1967 by Barclays Bank. Shepherd-Barron was awarded an OBE in the 2005 New Year's Honours List

The first ATMs accepted only a single-use token or voucher, which was retained by the machine. ATMs first came into wide use during the early- to mid-1980s.

Over the years many people have tried to lay claim to the title of "inventor of the ATM." Some believe that Luther George Simjian was the inventor because his idea came first. Some believe it was Don Wetzel; after all, he's got patents on display in the Museum of American History to prove it. Still others, including the Queen of England, say the inventor is John Shepherd-Barron.

Luther George Simjian

In the late 1930's, Luther George Simjian started building an earlier and not-so-successful version of an ATM, but he did register related patents. He initially came up with the idea of creating a hole-in-the-wall machine that would allow customers to make financial transactions; the idea was met with a great deal of doubt. Starting in 1939, Simjian registered 20 patents related to the device and persuaded what is now Citicorp to give it a trial. After six months, the bank reported that there was little demand. Today, as you know, there is a huge demand!

John Shepherd-Barron

John Shepherd-Barron had an idea in the 1960's for a 24/7 cash dispenser. At the time, he was managing director of De La Rue Instruments. De La Rue today manufactures cash dispensers. In fact, there is a De La Rue cash dispenser in 1 out of every 5 ATM machines built. If you want to believe that Shepherd-Barron invented the ATM, then the world's first ATM was installed outside a north London branch of Barclays Bank in 1967. Later In 1967, Shepherd-Barron presented his idea to a conference of 2,000 US bankers in Miami, after the first ATMs had been installed in England. He spoke to the conference about the new self-service banking device he developed. On December 31, 2004, John Shepherd-Barron, was named an Officer of the Order of the British Empire, or OBE, by the Queen of England for services to banking.

James Goodfellow

As a Development engineer with Smiths Industries Ltd, James Goodfellow was given the project of developing an automated cash dispenser in 1965. Chubb Lock & Safe Co was to provide the secure physical housing and the mechanical dispenser mechanism. Eventually Mr. Goodfellow designed a system which accepted a machine readable encrypted card, to which he added a numerical keypad. UK Patent No.1, 197,183 with a priority date of May 2 1966, covers this invention, and it is also covered by US Patent No.3, 905,461 and Patents granted by many other countries. These Patents list James Goodfellow as inventor, along with the late A.I.O.Davies, the company General Manager. This US Patent still describes the basic ATM function almost 40 years later. These Machines were marketed by Chubb LTD and installed nationwide in the UK during the late 60s and early 70s.

Don Wetzel

In 1968, Don Wetzel, says he was the Vice President of Product Planning at Docutel, the company that developed automated baggage-handling equipment. He applied for a patent on an ATM machine. He said there were two other inventors listed on the patent. They were Tom Barnes, a mechanical engineer and George Chastain, an electrical engineer. It took five million dollars to develop their ATM according to Mr. Wetzel.

John D. White

John D. White works started in 1968. His design was patented on May 9, 1973 for the Docutel Corporation and was filed on July 29, 1970. The machine was called a "Credit

Card Automated Currency Dispenser". A copy of his patent state the inventor of the machine was John D. White and Kenneth Goldstein, and the assignee on the patent was the Docutel Corporation. It does seem to us that this is very convincing evidence that it was White and not Wetzel who received the patent. There is also a statement in the patent that supports the idea of the modern ATM. "Both the original code and the updated code are scrambled in accordance with a changing key", which is basically what happens today. ATMs are programmed with security keys and the code changes and are scrambled to prevent fraudulent access to credit card and ATM numbers between the machine, the bank, and the network processor.

Jairus Larson

Jairus Larson did not claim to have invented the ATM, but developed the very first 'on-line' ATM (Diebold's "550"). The first ATM's were all 'off-line' versions (sometimes referred to as 'stand-alone') meaning they did not have any means to communicate with the bank. Today's ATMs are 'on-line' meaning they communicate with the bank's computer system. (Miller A.W, 2006)

2.1.1 History of ATM in Nigeria

There is no contesting the fact that the introduction of ATM has changed the face of electronic payment in Nigeria. Automated Teller Machines (ATM) was introduced into the Nigerian market in 1989, as a matter of fact; the very first ATM in Nigeria was installed by National Cash Registers (NCR) for the defunct Societe Generale Bank Nigeria (SGBN) in 1989.

Nigerian banks and the financial services industry in particular, have embraced the concept of e-money. Changes are beginning to take place in the Nigerian financial landscape and customers are increasingly raising the hope of expectations for quality customer services. They offer convenience to customers and provide banking services well beyond the traditional brick and mortar service period. They also ensure that a lot of cash is still within the banking system where it can be managed and channeled into productive use, instead of bulk withdrawals that we use to witness in the past. It is good for customers to withdraw cash that they need by eliminating the risk of loss through theft and fire. All in all it is has been win-win scenario for all the parties concerned.

Globally, Automated Teller Machines (ATMs) have been adopted and are still being adopted by banks. They offer considerable benefits to both banks and their depositors. The machines can enable depositors to withdraw cash at more convenient times and places than during banking hours at branches.

Adoption of Automated Teller Machines in Nigeria enable the automating of services that were previously completed manually, ATMs reduce the costs of servicing some depositor demands. These potential benefits are multiplied when banks share their ATMs, allowing depositors of other banks to access their accounts through a bank's ATM (McAndrews, 2003).

In Nigeria the deployment of ATM by banks and its use by bank customers is just gaining ground and has burgeoned in recent times. This has happened especially after the recent consolidation of banks, which has in all probability, made it possible for more banks to afford to deploy ATMs or at least become part of shared networks (Fasan, 2007). The increased deployment of ATMs in the banking sector has made the issue of

technology relevance important. ATM services have a history that is about twenty years in Nigeria. At first, they were operated as elitist services designed for those desirous of exclusive service. Cards were rare and the process for obtaining them tortuous.

Presently, the use of ATM cards has been widely promoted. Banks no longer appear to want personal contact with their customers. Some banks have resorted to penalizing the customer as it were, for not possessing an ATM card, by debiting the account of such a customer for withdrawing below a certain amount across the counter. Agboola (2006) reported that although only a bank had an ATM in 1998, by 2004, fourteen of them had acquired the technology. Agboola (2006) discovered that the adoption of ICT in banks has produced largely positive outcomes such as improved customer services, more accurate records, ensuring convenience in business time, prompt and fair attention, and faster services etc. Also, the banks' image is improved creating a more competent market. Work has also been made easier, and more interesting, the competitive edge of banks, relationship with customers, and the solution of basic operational and planning problems has been improved. Fanawopo (2006) stated that Nigeria's debit card transactions rose by 93 per cent between January 2005 and March 2006 over previous years owing to aggressive roll out initiatives by Nigerian banks, powered by Interswitch network. The number of ATM transactions through the Interswitch network had increased from, 1,065,972 in 2004, to 14, 448, 615 between January 2005 to March 2006. This is a rise of 92.6 percent with respect to the previous years.

More than 800 ATMs have been deployed on the network, while about 2 million cards have been issued by 23 banks as at March 2006.

2.2 Types of payment Systems

Cash Payment

This is a direct payment of raw cash in a seller/buyer relationship. This involves physical movement of cash from one place to another

Direct debit

A direct debit gives your beneficiary the authority to claim payments from your bank account. You will need to fill in a direct debit form, which you can get from your bank and return it to them. Direct debits will continue until you tell your bank to stop making the payments.

Standing order

A standing order gives an instruction to your bank to pay set amounts to your recipient. To set up a standing order you have to tell your bank how much to pay the recipient, on which dates, giving the bank your details. You will need to renew your standing order each year as the amount of each installment and the reference number will probably change.

Online and e-billing

Many organizations accept online payments, and offer an electronic or e-billing service. This let you enter your details of where you live and others. Then you can fill in all

other necessary information, including your account information, PIN, authorization and fund transfer.

2.3 Types of ATM Systems

There are two primary types of automated teller machines, or ATMs. The basic units allow the customer to only withdraw cash and receive a report of the account's balance. The more complex machines will accept deposits, facilitate credit card payments and report account information. To access the advanced features of the complex units, you will usually need to be a member of the bank that operates the machine.

There are mainly two types of ATM's which differ according to the way they operate. They can be called as

1. Leased-line ATM
2. Dial-up ATM machines

Any ATM machine needs a data terminal with two inputs and four output devices. Of course, for this to happen there should also be the availability of a host processor. The host processor is necessary so that the ATM can connect and also communicate with the person requesting the cash. The Internet Service Provider (ISP) also plays an important role in this action. They act as the gateway to the intermediate networks and also the bank computer.

A leased-line ATM machine has a 4-wire, point to point dedicated telephone line which helps in connecting it with the host processor. These types of machines are preferred in

places where the user volume is high. They are considered high end and the operating costs of this type of a machine is very high.

The dial-up ATM machines only has a normal phone line with a modem and a toll free number. As these are normal connections their initial installation cost is very less and their operating costs only become a fraction of that of a leased-line ATM.

The host is mainly owned by the bank. It can also be owned by an ISP. If the host is owned by the bank only machines that work for that particular bank will be supported.

Some ATM machines allow us to make deposits, check account balances, get cash, and transfer money. Other ATM machines only give out cash and are commonly found in high-traffic areas such as convenience stores, movie theaters and hotels

Debit Card. A debit card is a plastic card that can be used in automated teller machines (ATMs) to withdraw cash or at point of sale (POS) terminals in retail stores to buy something. Some merchants allow you to obtain cash when paying for a POS purchase with a debit card, but may charge you a fee. Debit card transactions are Automatically debited (subtracted) from your checking or savings account.

There are two main types of debit cards: the PIN-based debit card and the signature-based debit card. PIN-Based Debit Cards use a Personal Identification Number (PIN) to authorize the transaction. The transaction amount is then immediately deducted from your account.

Signature-Based Debit Cards use your signature to authorize the transaction. The transaction amount is usually deducted from your account within two to three business

days following the transaction. To obtain this type of debit card, you may have to meet special requirements, such as a satisfactory credit history, an account in good standing and/or have an established account for a certain length of time.

2.4 ATM Security

An ATM card is secured as long as the PIN number is kept as a secret. There is no way to get the PIN number from your card as it is encrypted by strong software's like Triple Data Encryption Standard. To keep your PIN number secure, there are a number of ways. Select your own PIN number. Select a PIN number which is easy to remember. It should not be anything that is associated to your birth date, phone number or anything personal. Do not write down the PIN number on the back of your ATM card.

Take out the card from your purse before reaching the ATM counter. There is more chance for an attack if you are standing in front of the ATM.

After entering the ATM counter close the door and then only turn around to the screen. Stand directly in front of the keypad, so that no one else sees the number you are pressing.

After receiving the money, do not start counting the money right away. Put the money inside your purse at once. Keep the card also safely.

There may also be cases where you may not receive the money because of a faulty ATM machine. In such cases, do not forget to take the ATM card.

If you are ever forced to take the money out of an ATM machine by a stranger, just enter the number in the reverse order. For example, if your real PIN number is 1234 enter it as 4321. This will send a signal to the nearby police control room. Thus you can get help at the earliest.

2.5 Problems and Solutions

Robbery and theft at ATMs are the only two of several related problems that must be addressed. The following are related cases.

- Robbery of couriers who fill ATMs with cash
- Theft of personal identification numbers (PINs) (including theft by "shoulder surfing")
- Theft by electronic data interception
- Theft by fraudulent electronic transactions
- Theft of money from ATMs by bank/ATM service employees
- Burglary of ATMs (including theft of entire ATMs)
- Vandalism of ATMs
- Fraudulent use of ATM cards obtained from customers through dummy ATMs that keep their cards.

Therefore your ATM card should be kept secured and safely without being scratched or bent. Keep it in your purse or somewhere else safe.

CHAPTER THREE

SYSTEM ANALYSIS AND DESIGN

3.1 System Analysis

This project attempts to put forward the analysis of an Automated Teller Machine (ATM) payment system, a device used by bank customers to process account transactions. Typically, a user inserts into the ATM a special plastic card that is encoded with information on a magnetic strip. The strip contains an identification code that is transmitted to the bank's central server. To prevent unauthorized transactions, a personal identification number (PIN) must also be entered by the user using a keypad. The computer then permits the ATM to complete the transaction; most machines can dispense cash, accept deposits, transfer funds, and provide information on account balances.

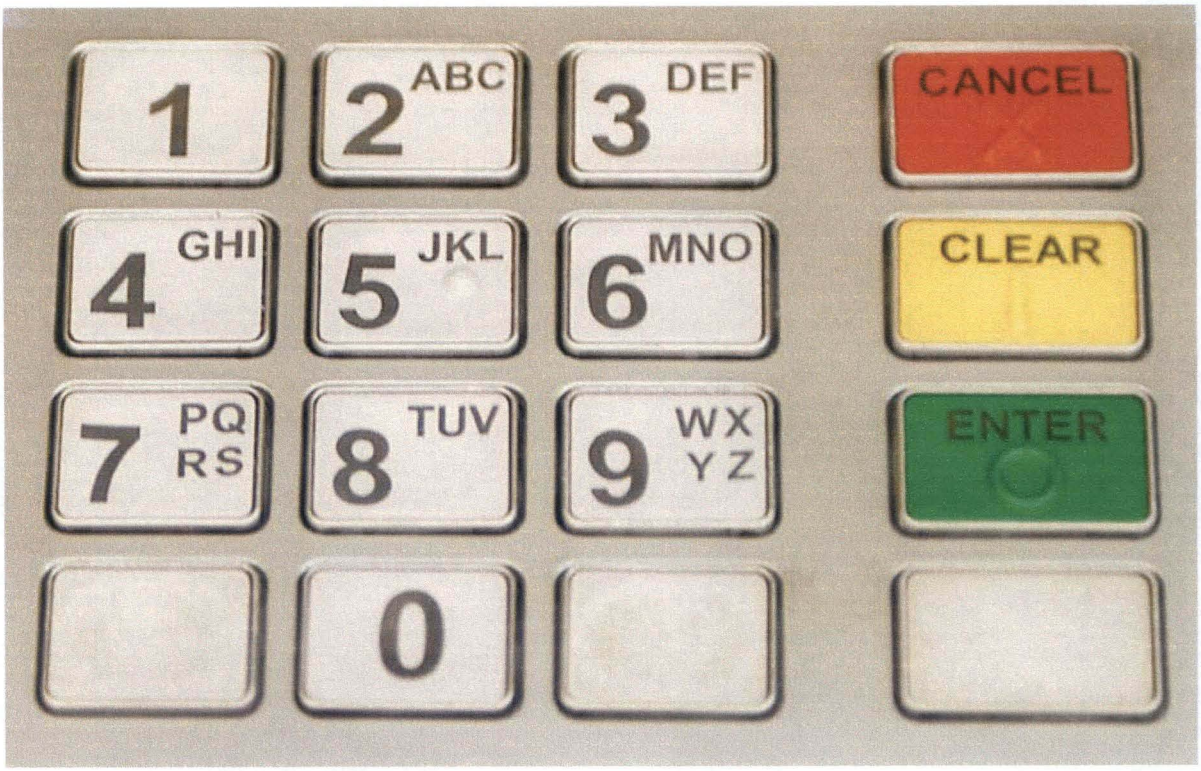

Fig 3.1 ATM Machine Keyboard

3.1.1 Technology behind Automated Teller Machine

ATM Networking

When a transaction is made, the details are inputted by the card holder. This information is passed on to the host processor by the ATM machine. The host processor checks these details with the authorized bank. If the details are correct, the requested cash by the card holder is taken with the help of an electronic fund from the customer's bank account to the host processor's account. After this function is carried out, the processor sends an approval code to the ATM machine so that the cash can be transferred.

3.2 Concept and Architecture of the Automated Teller Machine

An ATM system is a real-time front terminal of Automated teller services with the support of a central bank server and a centralized account database. The architecture of the ATM system, as shown in Fig.3.2 , encompasses an ATM processor, a system clock, a remote account database, and a set of peripheral devices such as the card reader, monitor, keypad, bills storage, and bills disburser.

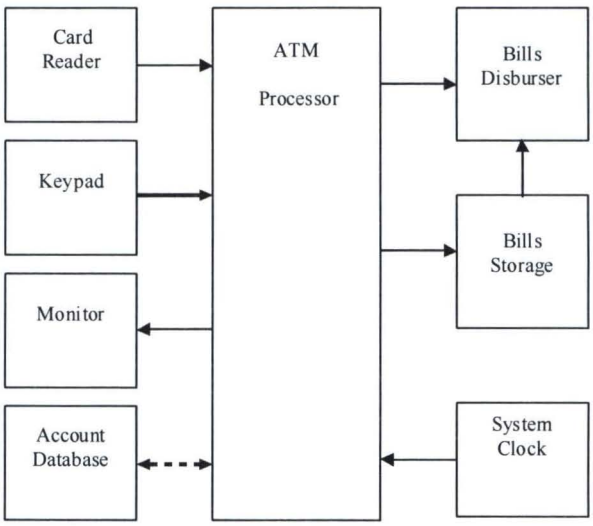

Fig. 3.2 The conceptual model of the ATM system

The conceptual model of an ATM system is used to be described by a Finite State Machine (FSM), which adopts a set of states and a set of state transition functions modeled by a transition diagram or a transition table to describe the basic behaviors of the ATM system. On the basis of the conceptual model of the ATM system as given in

Fig. 3.2, the top level behaviors of ATM can be modeled in a transition diagram as shown in Fig. 3.3.

Corresponding to the transition diagram of the ATM as given in Fig. 3.3, a formal model of the ATM system as an FSM, ATMST, is defined as a 5-tuple as follows:

$$ATM\text{ST A } (S, \Sigma, s, F, \delta) \quad (1)$$

where

- S is a set of valid states that forms the domain of the ATM, $S = \{s_0, s_1, ..., s_7\}$ where the states are: s_0 – System, s_1 – Welcome, s_2 - Check PIN, s_3 – Input withdraw amount, s_4 - Verify balance, s_5 - Verify bills availability, s_6 - Disburse bills, and s_7 - Eject card, respectively;
- Σ is a set of events that the ATM may accept and process, $\Sigma = \{e_0, e_1, ..., e_{10}\}$ where e_0 - Start, e_1 - Insert card, e_2 - Correct PIN, e_3 - Incorrect PIN, e_4 – Request ≤ max, e_5 – Request > max, e_6 - Cancel transaction, e_7 - Sufficient funds, e_8 - Insufficient funds, e_9 - Sufficient bills in ATM, and e_{10} - Insufficient bills in ATM;
- s is the start state of the ATM, $s = s_1$ (Welcome);
- F is a set of ending states, $F = \{s_1\}$;
- δ is the transition function of the ATM that determines the next state of the FSM, s_{i+1}, on the basis of the current state s_i and a specific incoming event e_i, i.e., $s_{i+1} = \delta (s_i, e_i)$, where

$$\delta = f: S \times \sum \rightarrow S \qquad (2)$$

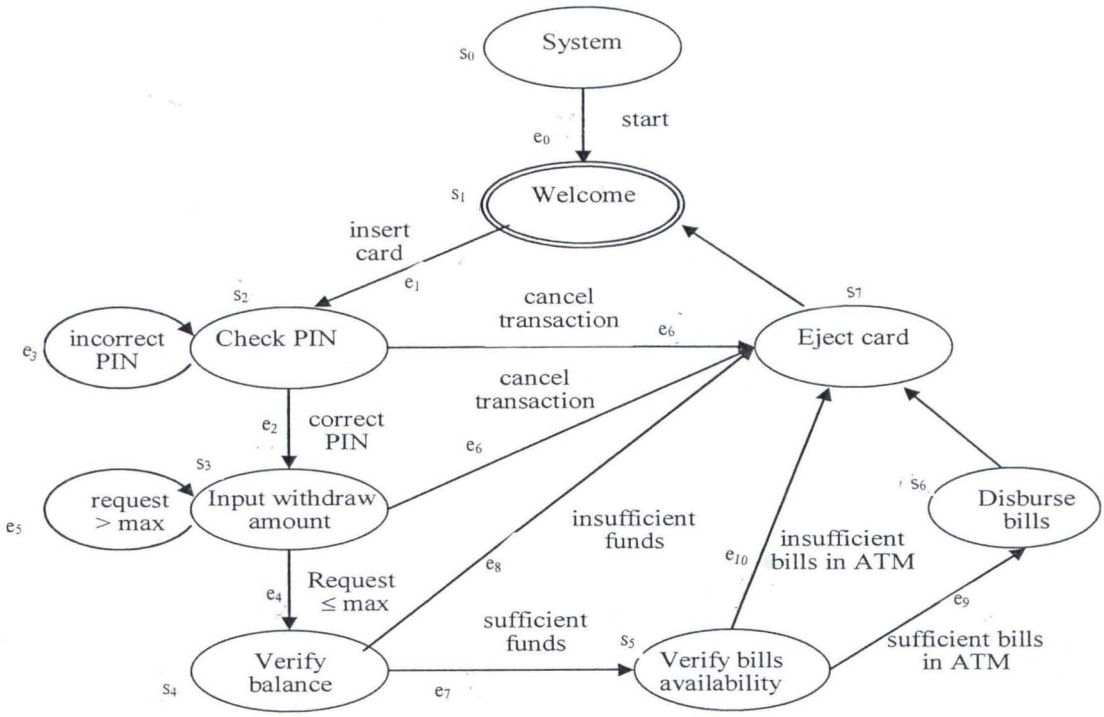

Fig. 3.3 The transition diagram of the ATM behaviors

The top level framework of the ATM system can be modeled by a set of architecture, static behaviors, and dynamic behaviors using Real-Time Process Algebra (*RTPA*) *(Wang, 2008) as follows:*

§(ATM) A ATM**§**.Architecture**ST**
|| ATM**§**.StaticBehaviors**PC**
|| ATM**§**.DynamicBehaviors**PC**

3

where || indicates that these three subsystems related in parallel, and §, ST, and PC are type suffixes of *system, system structure,* and *process*, respectively.

The conceptual models of ATM as presented in Figs. 3.2 describe the configuration, basic behaviors, and logical relationships among components of the ATM system.

The Architectural Model of the ATM System

The architecture of a hybrid hardware/software system, particularly a real-time system, is a system framework that represents the overall structure, components, processes, and their interrelationships and interactions. This section specifies the architecture of the ATM system, ATM§. ArchitectureST, by a high-level architectural framework based on its conceptual model as provided in Fig. 3.2. Then, each of its architectural components will be refined as a Unified Dimensional Model- UDM, (also known as *Component Logical Model* (CLM)) (Wang, 2008).

System architectures, at the top level, specify a list of structural identifiers of UDMs and their relations. A UDM may be regarded as a predefined class of system hardware or internal control models, which can be inherited or implemented by corresponding UDM objects as specific instances in the succeeding architectural refinement processes for the system.

Corresponding to the conceptual model of ATM as shown in Figs. 3.2 to 3.4, the high-level specification of the architecture of ATM, ATM§.ArchitectureST, is given in Fig. 3.4 in RTPA. ATM§.ArchitectureST encompasses parallel structures of a set of UDMs such as the ATMProcessorST, CardReaderST, KeypadST, MonitorST, BillStorageST, BillsDisburserST, AccountDatabaseST, and SysClockST, as well as a set of system events @EventsS and a set of statuses &StatusBL. The numbers in the angel brackets indicate the configuration of how many data objects that share the same UDM.

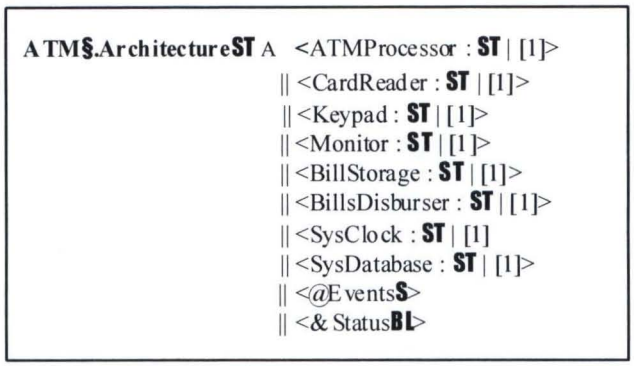

Fig. 3.4 The architectural framework of the ATM system

The set of events of ATM are predefined global control variables of the system, as given in Eq. 4, which represent an external stimulus to a system or the occurring of an internal change of status such as an action of users, an updating of the environment, and a change of the value of a control variable. Types of general events, @EventS, that may trigger a behavior in a system can be classified into operational (@*e*S), time (@*t*TM), and interrupt (@*int*⦿) events where @ is the *event prefix*, and S, TM, and ⊙ the type suffixes of string, time, and interrupt, respectively, i.e.:

$$\begin{aligned} \text{ATM§.Architecture}\mathbf{ST}\text{.Events}\mathbf{ST}\ \text{A}\quad & @\text{SysInitial}\mathbf{S} \\ & |\ @\text{t}\mathbf{TM} = \S\mathbf{hh:mm:ss} \\ & |\ @\text{SysClock100msInt} \end{aligned} \tag{4}$$

In RTPA, a status denoted by □*s*BL is an abstract model of system state in Boolean type with a status prefix □, such as an operation result and an internal condition. The ATM statuses as a set of predefined global control variables are as follows:

$$
\begin{aligned}
\mathrm{ATM}\S.\mathrm{Architecture}\mathbf{ST}.\mathrm{Status}\mathbf{ST}\ A \;=\; & \&\,\mathrm{CardReadStatus}\mathbf{BL} \\
& |\ \&\,\mathrm{MonitorStatus}\mathbf{BL} \\
& |\ \&\,\mathrm{KeypadStatus}\mathbf{BL} \\
& |\ \&\,\mathrm{BillStorageStatus}\mathbf{BL} \\
& |\ \&\,\mathrm{BillsDisburserStatus}\mathbf{BL} \\
& |\ \&\,\mathrm{BillsDisburseEngineStatus}\mathbf{BL} \\
& |\ \&\,\mathrm{BillsAvailable}\mathbf{BL} \\
& |\ \&\,\mathrm{BillsDisbursed}\mathbf{BL} \\
& |\ \&\,\mathrm{CardInserted}\mathbf{BL} \\
& |\ \&\,\mathrm{CardEjected}\mathbf{BL} \\
& |\ \&\,\mathrm{CancellKeyPressed}\mathbf{BL} \\
& |\ \&\,\mathrm{EnterKeyPressed}\mathbf{BL} \\
& |\ \&\,\mathrm{DataEntered}\mathbf{BL} \\
& |\ \&\,\mathrm{TimeOut}\mathbf{BL} \\
& |\ \&\,\mathrm{ServiceCompleted}\mathbf{BL} \\
& |\ \&\,\mathrm{ServiceCancelled}\mathbf{BL} \\
& |\ \&\,\mathrm{SystemFailure}\mathbf{BL} \\
& |\ \&\,\mathrm{SysShutDown}\mathbf{BL} \\
& |\ \&\,\mathrm{ValidAmount}\mathbf{BL} \\
& |\ \&\,\mathrm{ValidBalance}\mathbf{BL} \\
& |\ \&\,\mathrm{ValidCard}\mathbf{BL} \\
& |\ \&\,\mathrm{ValidPIN}\mathbf{BL}
\end{aligned}
$$

(5)

The UDM Structures of the ATM System

As modeled in Fig. 3.4, the ATM system encompasses eight UDMs for modeling the system hardware interfaces and internal control structures. It is recognized that UDMs are a powerful modeling means in system architectural modeling (Wang, 2008), which can be used to unify user defined complex data objects in system modeling, and to represent the abstraction and formalization of domain knowledge and structural information. The generic mathematical model of UDMs is tuples. Each of the eight UDMs of the ATM system is designed and modeled in the following subsections, except that the ATMProcessorST will be embodied by its static and dynamic behavioral models in other sections.

(a) The UDM of the Card Reader

The card reader of the ATM system, CardReaderST, is an architectural model of the interface device, which accepts an inserted bank card, scans predesigned identification information on the card, and returns the card to users. The UDM model of CardReaderST specifies seven functional fields as shown in Fig.3.5. The card input port is an input structure consisting of two fields known as the CardInputAddressH and CardInputN. The card insert port is an output structure consisting of two fields known as the CardInsertAddressH and CardInsertEngineBL. The card eject port is another output structure consisting of two fields known as the CardEjectAddressH and CardEjectEngineBL. There are three CardReaderST operating statuses modeled in the fields of CardReadStatusBL, CardInsertStatusBL, and CardEjectStatusBL.

```
CardReaderST A (<PORTST(<CardInputAddress : H | CardInputAddressH = FF00H>,
                        <CardInput : N | 0 ≤ CardInputN ≤ 1000000>)>,
                <CardReadStatus : BL | CardReadStatusBL = {(T, Normal), (F, Faulty)}>,
                <PORTST(<CardInsertAddress : H | CardInsertAddressH = FF01H>,
                        <CardInsertEngine : BL | CardInsertEngineBL = {(T, On), (F, Off)}>)>,
                <CardInsertStatus : BL | CardInsertStatusBL = {(T, Normal), (F, Faulty)}>,
                <PORTST(<CardEjectAddress : H | CardEjectAddressH = FF01H>,
                        <CardEjectEngine : BL | CardEjectEngineBL = {(T, On), (F, Off)}>)>,
                <CardEjectStatus : BL | CardEjectStatusBL = {(T, Normal), (F, Faulty)}>
               )
```

Fig. 3.5 The refined UDM model of the card reader

(b) The UDM of the Keypad

The keypad of the ATM system, KeypadST, is an architectural model of the interface device for users entering required information such as the personal identification number (PIN) and withdraw amount of money. The UDM model of KeypadST specifies

five functional fields with certain design constraints as shown in Fig. 3.6. The field of PortAddressH represents the physical input address of the keypad. The field of InputDigitsH represents information (≤ 4 digits) entered from the keypad. The field of KeypadStatusBL represents the working conditions of the keypad. The fields of EnterPressedBL and CancelPressedBL represent a valid or invalid input entered by the keypad, respectively.

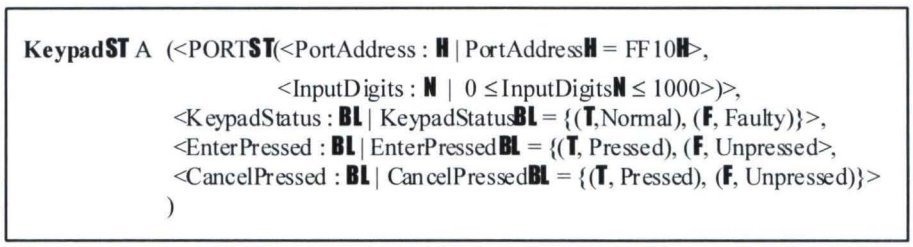

Fig. 3.6 The refined UDM model of the keypad

(c) The UDM of the Monitor

The monitor of the ATM system, MonitorST, is an architectural model of the output device that displays system operational and status information to users. The UDM model of MonitorST specifies four functional fields with certain design constraints as shown in Fig. 3.7. The field of PortAddressH represents the physical output address to the monitor. The field of OutputInformationS represents a string of letters (≤ 255 characters) that will be displayed on the monitor. The field of MonitorStatusBL represents the operational conditions of the monitor. The field of CurrentDisplyS is a system feedback of the latest output information on the monitor.

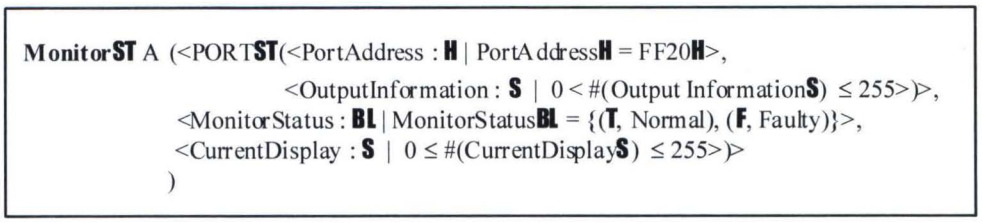

Fig. 3.7 The refined UDM model of the monitor

(d) The UDM of the Bills Storage

The bills storage of the ATM system, BillStorageST, is an architectural model of the internal device that stores bills in different notes, which can be sent to the bills disburser in various combinations. The UDM model of BillStorageST specifies six functional

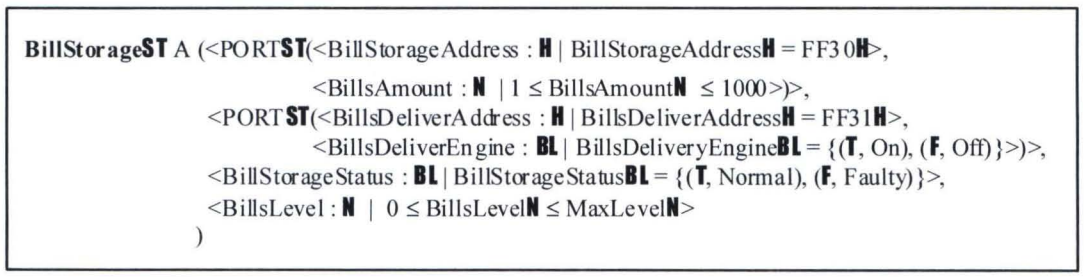

Fig 3.8 The refined UDM of the Bills Storage

fields with certain design constraints as shown in Fig. 3.8. The bills storage port is an output structure consisting of two fields known as the BillStorageAddressH and BillsAmountN. The bills deliver port is an output structure consisting of two fields known as the BillsDeliverAddressH and BillsDeliverEngineBL. The field of BillStorageStatusBL represents the operational conditions of the bills storage. The field of BillsLevelN represents the current level of bills in the bills storage.

(e) The UDM of the Bills Disburser

The bills disburser of the ATM system, BillsDisburserST, is an architectural model of the output device that delivers bills of requested amount from the bills storage to the customer. The UDM model of BillsDisburserST specifies four functional fields with certain design constraints as shown in Fig. 3.9. The disburser drive port is an output structure consisting of two fields known as the DisburserDriveAddressH and DisburseEngineBL. The field of BillsDisburserStatusBL represents the operational conditions of the bills disburser. The field of AmountDisbursedN is a system feedback signal of bills disbursed to the customer in the current transaction.

BillsDisburserST A (<PORT**ST**(<DisburserDriveAddress : **H** | DisburserDriveAddress**H** = FF41**H**>,
<DisburseEngine : **BL** | DisburseEngine**BL** = {(**T**, On), (**F**, Off)}>)>,
<BillsDisburserStatus : **BL** | BillsDisburserStatus**BL** = {(**T**, Normal), (**F**, Faulty)}>,
<AmountDisbursed : **N** | 1 ≤ AmountDisbursed**N** ≤ 1000>)>
)

Fig. 3.9 The refined UDM model of the bills disburser

(f) The UDM of the System Clock

The system clock of the ATM system is an architectural model for event timing, process duration manipulation, and system synchronization. The UDM model of the system clock, SysClockST, is designed as given in Fig. 3.10. SysClockST provides an *absolute* (calendar) clock CurrentTimehh:mm:ss as the logical time reference of the entire system and a *relative* clock §tN as a generic counter of the ATM system. The InterruptCounterN is adopted to transfer the system timing ticks at 100ms interval into

the second signal. The real-time system clock is updated by the process SysClockPC, which will be described in the following section on system static behaviors.

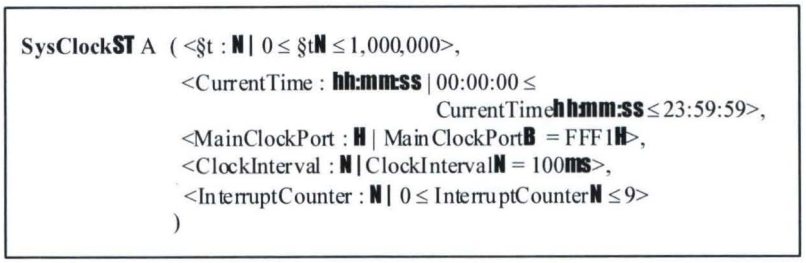

Fig. 3.10 The refined UDM model of the system clock

(g) The UDM of the System Database

The system database of the ATM system, SysDatabaseST, is an architectural model of the internal centralized database located in the bank`s server where the ATM connects to. The ATM uses the card number scanned from a bank card and the PIN entered from the keypad to access the system database in order to verify the validity of the card and information recorded in the corresponding account in SysDatabaseST, such as the card holder, current balance, and withdraw constraints.

The UDM model of SysDatabaseST specifies a set of accounts with seven functional fields as shown in Fig. 3.11. The field of AccountNumN represents a specific account existed in the system that is corresponding to the number assigned to the bank card. The field of AccountStatusBL represents the current status of an account such as active or inactive in the system. The field of PINH represents a user defined PIN (≤ 4 digits) recorded in the system. The field of CardHolderS records the name of person that holds the account. The field of BalanceN represents the current remaining money in the given account. The field of MaxAllowableWithdrawN represents the limit set by the bank for

the given account. The field of CurrentWithdrawN specifies the valid user requested amount of withdraw in the current transaction.

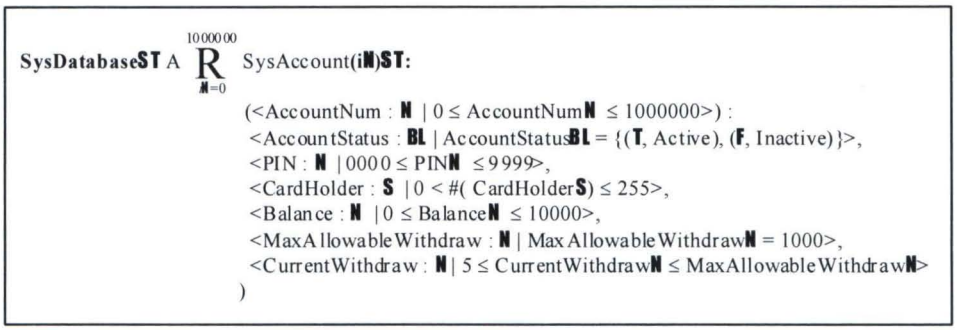

Fig. 3.11 The refined UDM model of the system database

The system architectural models specified in this section provide a set of abstract object models and clear interfaces between system hardware and software. By reaching this point, the co-design of a real-time system can be carried out in parallel by separated hardware and software teams. It is recognized that system *architecture specification* by the means of UDMs is a fundamental and difficult phase in software system modeling, while conventional formal methods hardly provide any support for this purpose. From the above examples in this subsection, it can be seen that RTPA provides a set of expressive notations for specifying system architectural structures and control models, including hardware, software, and their interactions. On the basis of the system architecture specification and with the work products of system architectural components or UDMs, specification of the operational components of the LDS system as behavioral processes can be carried out directly as elaborated in the following sections.

3.3 Proposed Solution

Although ATMs were originally developed as just cash dispensers, they have evolved to include many other bank-related functions. This project seeks to advance the alternative use of ATM for the purpose of making payment. In some countries, especially those which benefit from a fully integrated cross-bank ATM network (e.g.: Multibanco in Portugal), ATMs include many functions which are not directly related to the management of one's own bank account, such as:

- Paying routine bills, fees, and taxes (utilities, phone bills, taxes, legal fees e.t.c)
- Printing bank statements
- Updating passbooks
- Loading monetary value into stored value cards
- Purchasing

The ability to quickly and easily complete a transaction can be a major boost to delivering a positive customer experience. The failure of a single device can lead to delays and disruptions that result in dissatisfy customers. Avoiding these types of problems is critical to running a successful business and monitoring every aspect of the transaction process can play an important role in ensuring uninterrupted operations. To provide a high level of performance you must have the ability to monitor every device in the transaction network on a real-time basis, and be able to react quickly as problems arise to avoid adverse customer service.

- Improve the customer relationship
- Reduce operating costs associated with unscheduled maintenance

- Reduce downtime

3.4 Design and Development

3.4.1 Methodology

In general, Methodology is a systematic description of the sequence of activities required to solve a problem. In context to system development, methodology is a collection of procedures, techniques, tools and documentation aids, which help the system developers in their efforts to implement a new information system. Programming and Database designs are used in this project.

3.4.2 Programming

Visual Basic (VB 6.0) was used in the programming design of this project because of its user friendliness couple with its flexibility and the compatibility with Microsoft Operating Systems, which is a de-facto commercial Operating System (OS) that most people are accustomed to.

Visual Basic (VB) is the third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model. VB is also considered a relatively easy to learn and use programming language, because of its graphical development features and BASIC heritage.

Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data

3.5 Database Design

A database is a collection of information categorized by specific fields. Databases are usually searchable by keywords. It is a logical collection of interrelated information, managed and stored as a unit, usually on some form of mass-storage system such as magnetic tape or disk. To access and process the data stored, a database management system is needed such as the Microsoft Office Access used for the implementation of this project. Traditional databases are organized by fields, records, and files. A field is a single piece of information, a record is collection of field items; and a file is a collection of records.

In the design of this project a database named PHCNData was created making use of Microsoft Office Access 2007. The database contains PHCN customers details needed for successful remote payment of bills using ATM machine. For the purpose of this project a limited accounts were created for the implementation of the project, as shown in fig (3.12) below

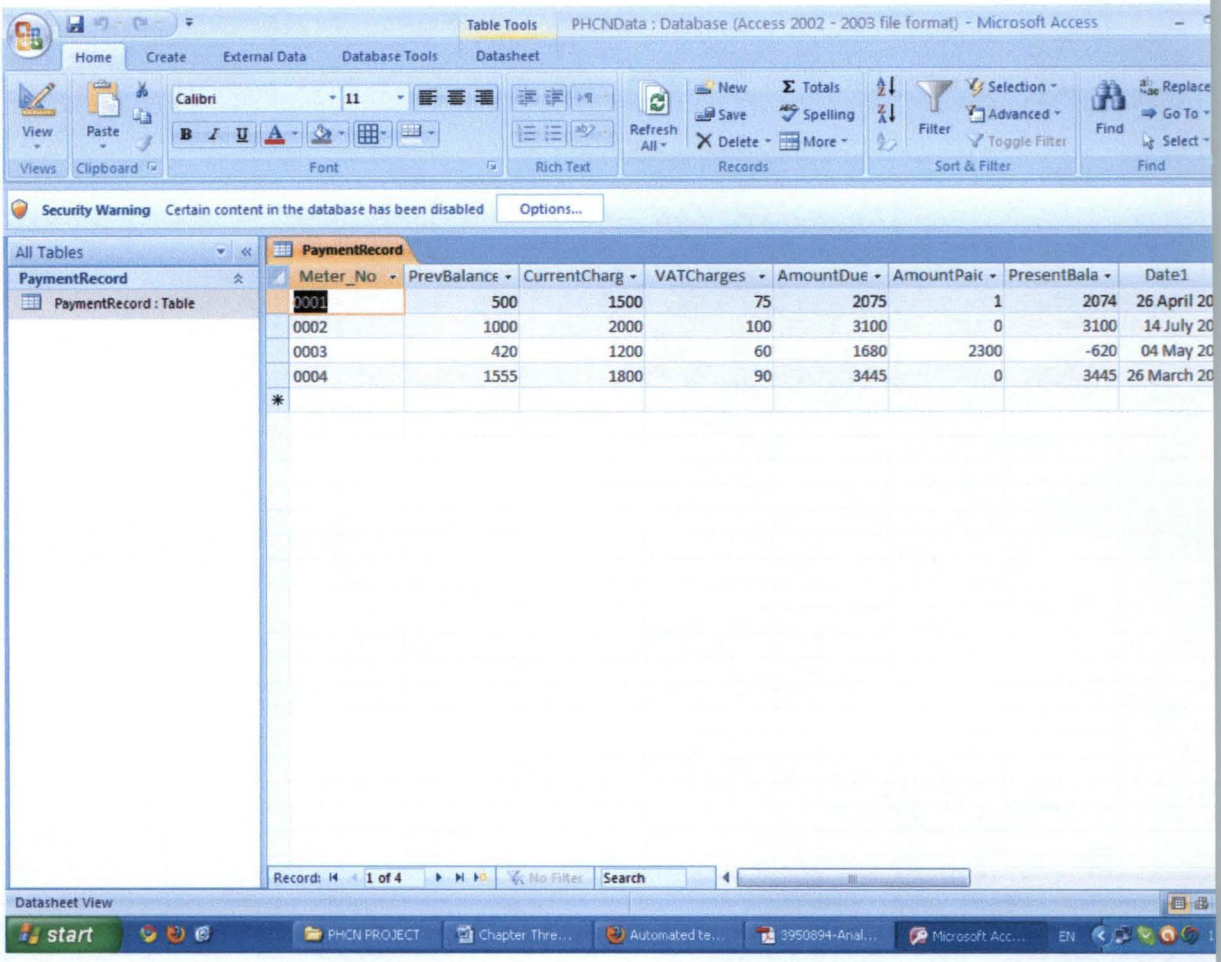

Fig. 3.12 Overview of Customer Data

CHAPTER FOUR

SYSTEM IMPLEMENTATION

After achieving the analysis and design of the proposed system, this chapter discusses the implementation procedures for the newly developed system - An Automated Teller Machine (ATM) Enabled Payment of PHCN Bills. The application has been designed with simplicity in such a way that anybody that can read simple English Language with previous knowledge of ATM usage can use the application for payment of PHCN bills, using ATM debit card.

4.1 Description of the System

This project is a self-service solution that includes all the attributes of a traditional ATM with bill payment capabilities in a single platform. Bill Payment solution offers PHCN customers the ability to pay their bills and to withdraw cash, quickly and securely. This project strives to eliminate the bottlenecks associated with manual payment of bills either in the PHCN local office or at Banks where numerous customers compete for attention and space. With this project, PHCN customers can conveniently walk to the nearest available ATM machine, insert their cards, input their PINs and make payment. The project is designed in such a way that the ATM screen will have an additional menu called "PHCN Bill" in addition to the normal traditional options. The application aims to simulate the real-life ATM payment system that will improve upon the traditional

way of paying bills to the PHCN. Your bill payment will be made easier, through the Automated Teller Machine "ATM"

Bill Payment Service:

By using this service you can pay the full amount of your monthly bill or part of it and you will get **Paid Amount and Last Bill Date**.

Steps:

1. Insert ATM card
2. Enter PIN number
3. Select "**Types of Account**"
4. Select "**PHCN Bill**"
5. Input "**Amount**"
6. Record Inserted **"OK"**
7. Enter meter number again to "**Confirm**" to proceed
8. If the wrong meter number was entered, error screen will be displayed and the transaction will not be completed
9. If the transaction is completed successfully then a screen will be displayed and the receipt can be printed
10. If the transaction is not completed due to bank communication problem a message will display

4.2. System Requirement

Requirements for ATM System

The software to be designed will control a simulated automated teller machine (ATM). The ATM application developed for the purpose of this project will not communicate with the bank's computer over an appropriate communication link. (The software on the latter is not part of the requirements for this project)

The ATM will service one customer at a time. A customer will be required to insert an ATM card and enter a personal identification number (PIN) - both of which will be sent to the bank for validation as part of each transaction. The customer will then be able to perform one or more transactions. The card will be retained in the machine until the customer indicates that he/she desires no further transactions, at which point it will be returned

The ATM must be able to provide the following services to the customer:

1. A customer must be able to make a cash withdrawal from any suitable account linked to the card. Approval must be obtained from the bank before cash is dispensed.
2. A customer must be able to make a bill payment from any suitable account linked to the card. The customer will enter the amount to be paid into the ATM and the stated amount is deducted from the Account.
3. A customer must be able to make a deposit to any account linked to the card, consisting of cash and/or checks in an envelope. The customer will enter the amount of the deposit into the ATM, subject to manual verification when the envelope is removed

from the machine by an operator. Approval must be obtained from the bank before physically accepting the envelope.

4. A customer must be able to make a transfer of money between any two accounts linked to the card.

5. A customer must be able to make a balance inquiry of any account linked to the card.

The ATM will communicate each transaction to the bank and obtain verification that it was allowed by the bank. In the case of a cash withdrawal or deposit, a second message will be sent after the transaction has been physically completed (cash dispensed or envelope accepted).

If the bank determines that the customer's PIN is invalid, the customer will be required to re-enter the PIN before a transaction can proceed. If the customer is unable to successfully enter the PIN after three tries, the card will be permanently retained by the machine, and the customer will have to contact the bank to get it back.

If a transaction fails for any reason other than an invalid PIN, the ATM will display an explanation of the problem, and will then ask the customer whether he/she wants to do another transaction.

The ATM will provide the customer with a printed receipt for each successful transaction, showing the date, time, machine location, type of transaction, account(s), amount, and ending and available balance(s) of the affected account ("to" account for transfers).

The system runs on Personal Computers, Microsoft Operating System (OS) with the following configurations:

1. Memory - 1024 MB or higher
2. Operating System – Pentium 4 or higher
3. Hard Disk – 160 GB or higher (With enough disk space)
4. Application – Microsoft Office 2003 or higher and Visual Basic 6.0

4.3. Implementation Environments

Welcome Screen

The Welcome screen interface was designed to reflect the actual operation that we plan to carry out; which is using ATM technology for payment of bills to PHCN. This interface also informs you to insert your ATM debit card to begin transaction.

Fig 4.1 Welcome Screen

Personal Identification Number (PIN)

This is where the user input the correct PIN number for authentication. This is a security feature that prevents fraudulent people from accessing your Bank account illegitimately. The security of your PIN is very crucial and it is a personal responsibility, it must be guarded seriously.

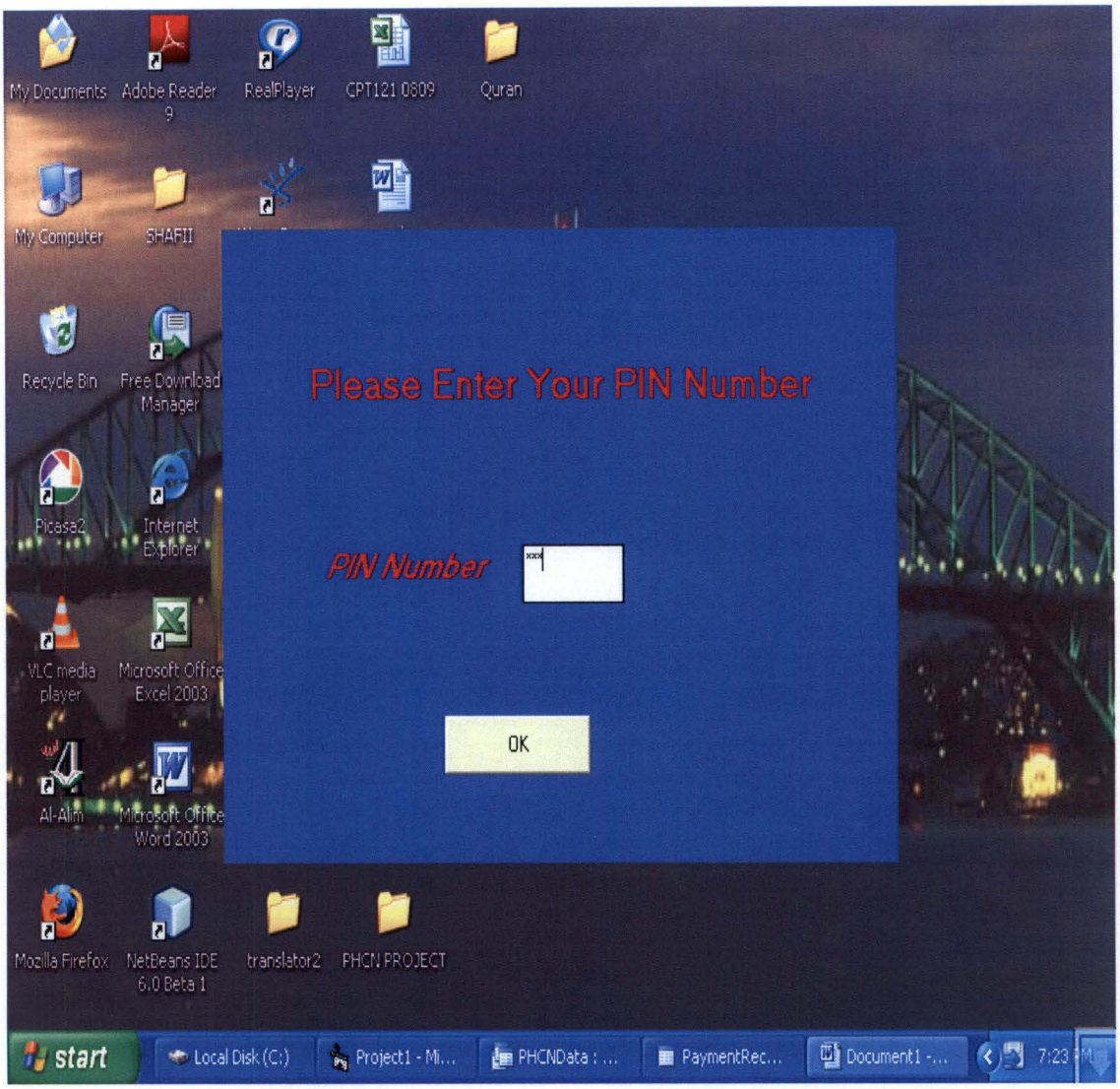

Fig 4.2 Personal Identification Number Interface

Wrong PIN

When you mistype your PIN number, the security feature of the ATM machine prevents you from further transaction, except you get it right. In some ATM machine, after three attempts, of unsuccessful PIN input, the ATM machine will automatically withdraw the ATM debit card by ingestion. If you are the owner of the card you can proceed to

complain to the Customer service of the Bank where you have account that is linked with the ATM card.

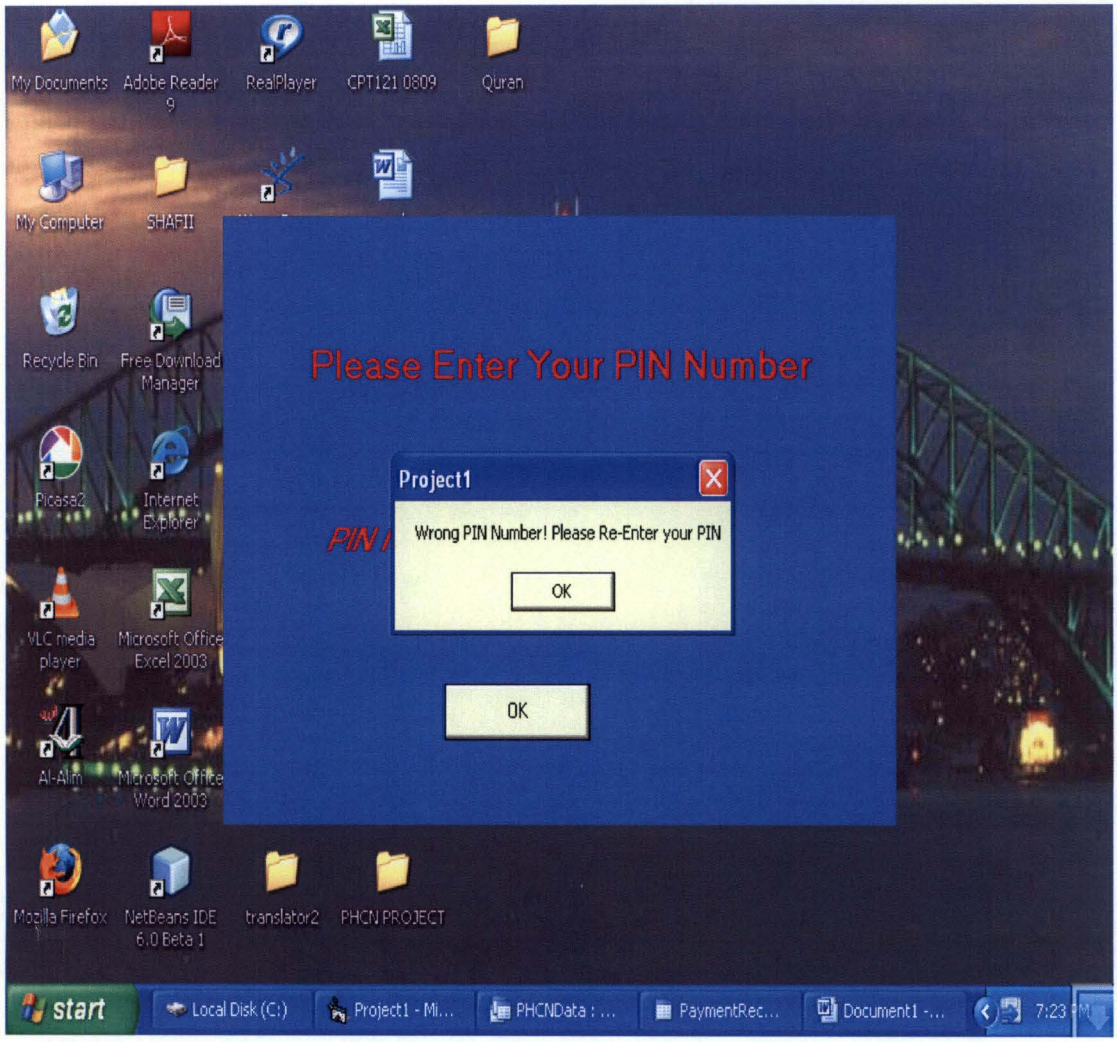

Fig 4.3 Wrong PIN Interface

Type of Bank Account Interface

A legitimate ATM user must chose the type of Bank account he/she operates, from where deduction is going to be make once payment transaction is completed. Although

different Banks operate different types of account, only Saving Account and Current Account were used for the purpose of this project and because this are the two main Account you will see in any ATM Machine in Nigeria at the moment.

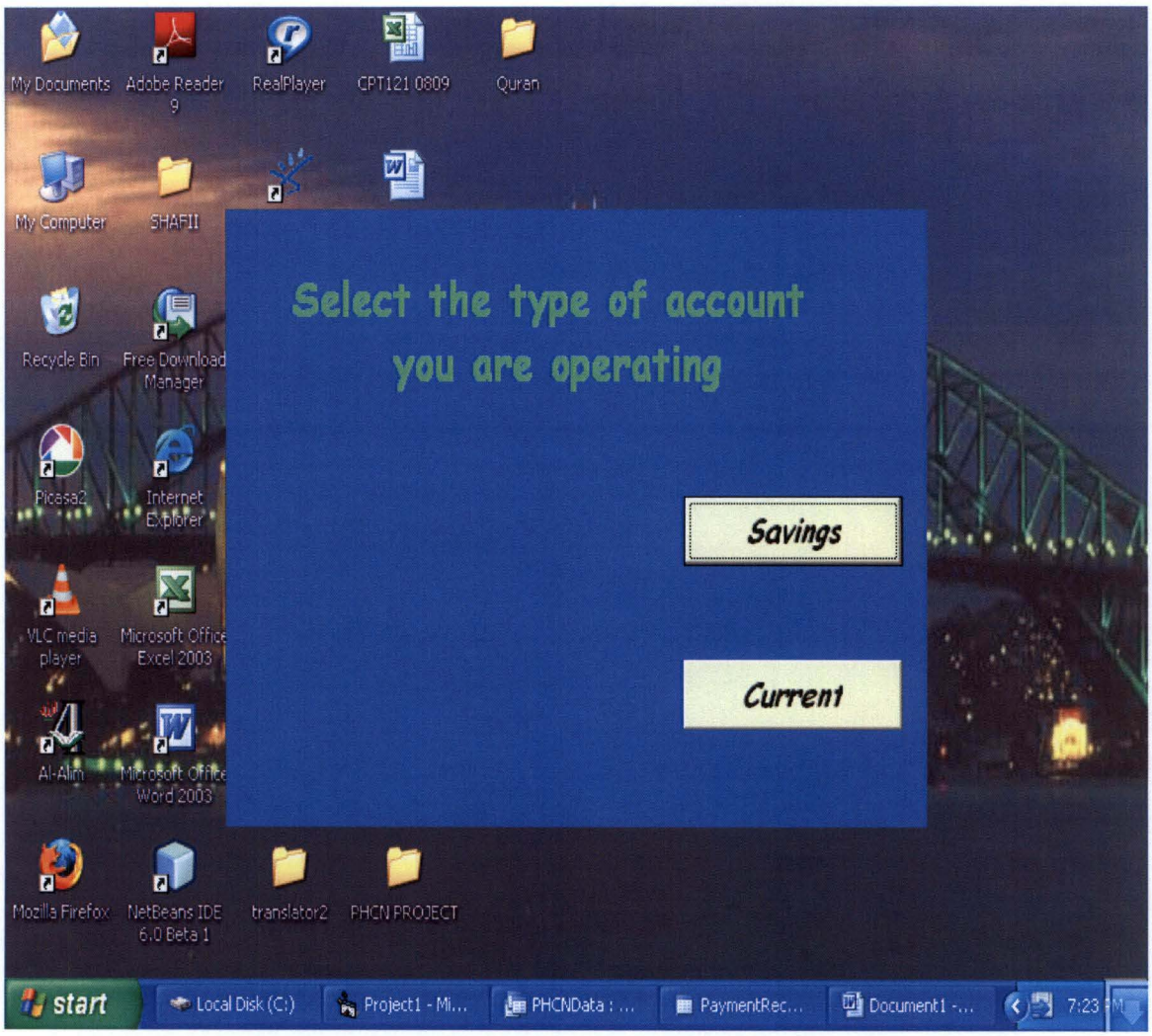

Fig 4.4 Type of Account Interface

PHCN Bill Interface

After the process of authentication must have been successful, and the type of account selected, you are then directed to PHCN BILL option. Because the emphasis is on bill

payment, only the PHCN BILL option is enable in this project. When you select PHCN BILL, you can then proceed to make necessary transaction.

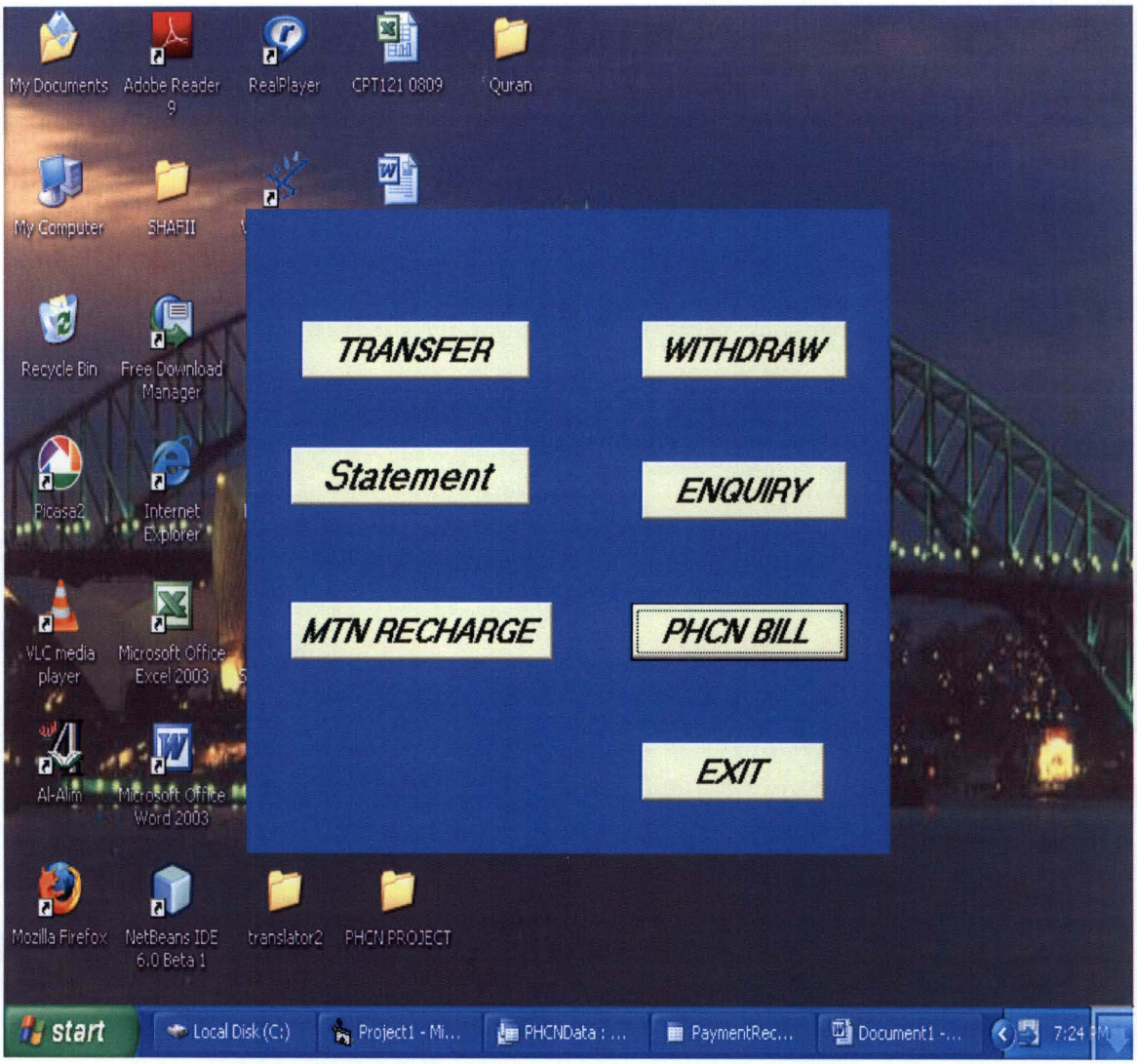

Fig. 4.5 PHCN Bill Interface

PHCN Information Interface

This is the interface where the unique PHCN Meter number is inserted and the Amount to be paid. Since the Meter number is unique, no two Meter numbers can be the same. Here care must be taken so as not to enter a wrong Meter number that might belong to another person entirely.

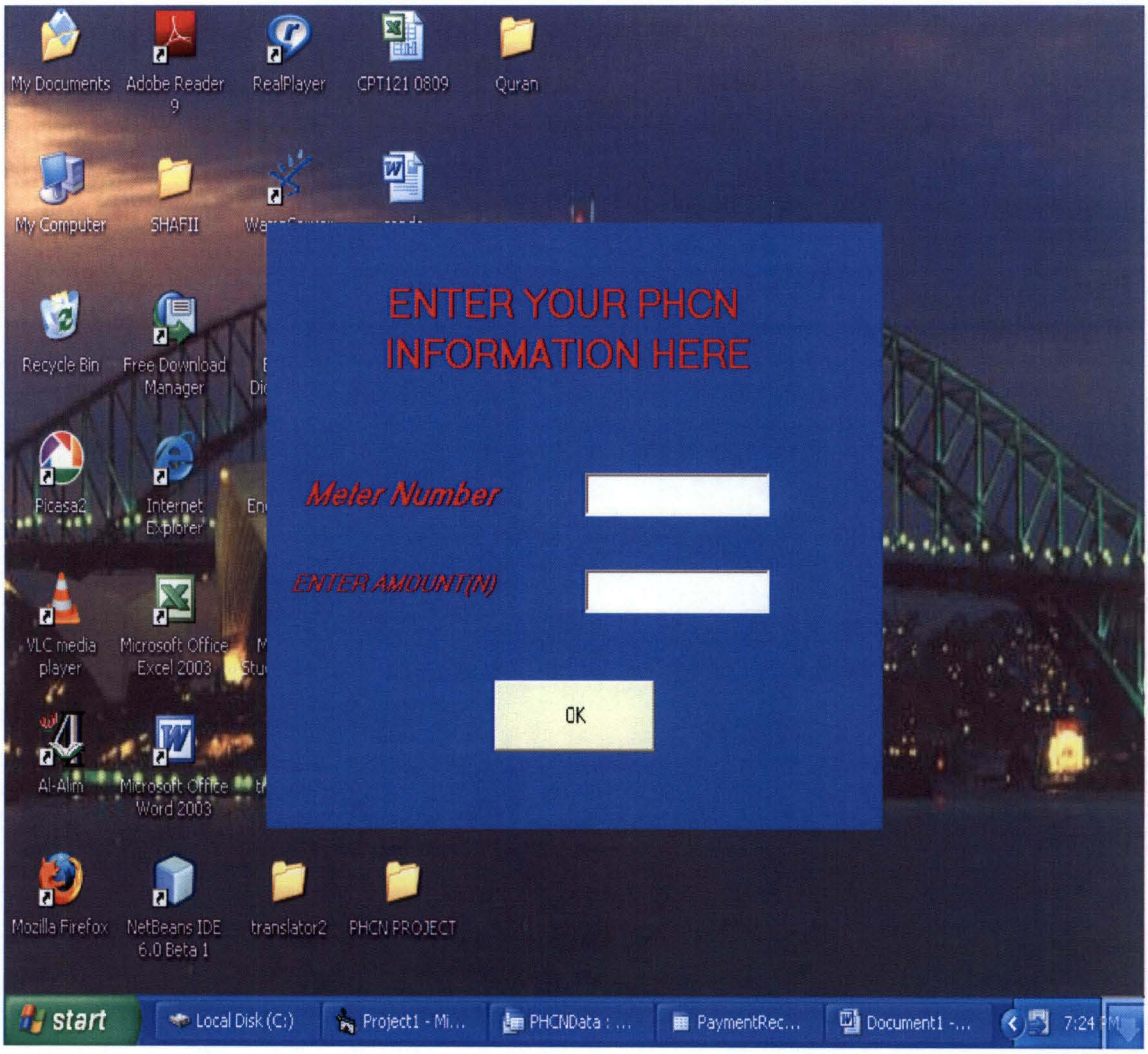

Fig 4.6 PHCN Information Interface

Record information Page

If all the information supplied is correct, there appear a prompt that tells you that your record was inserted. This is the continuation of the previous interface. It alert you that you are about to make payment based on the information you have supplied.

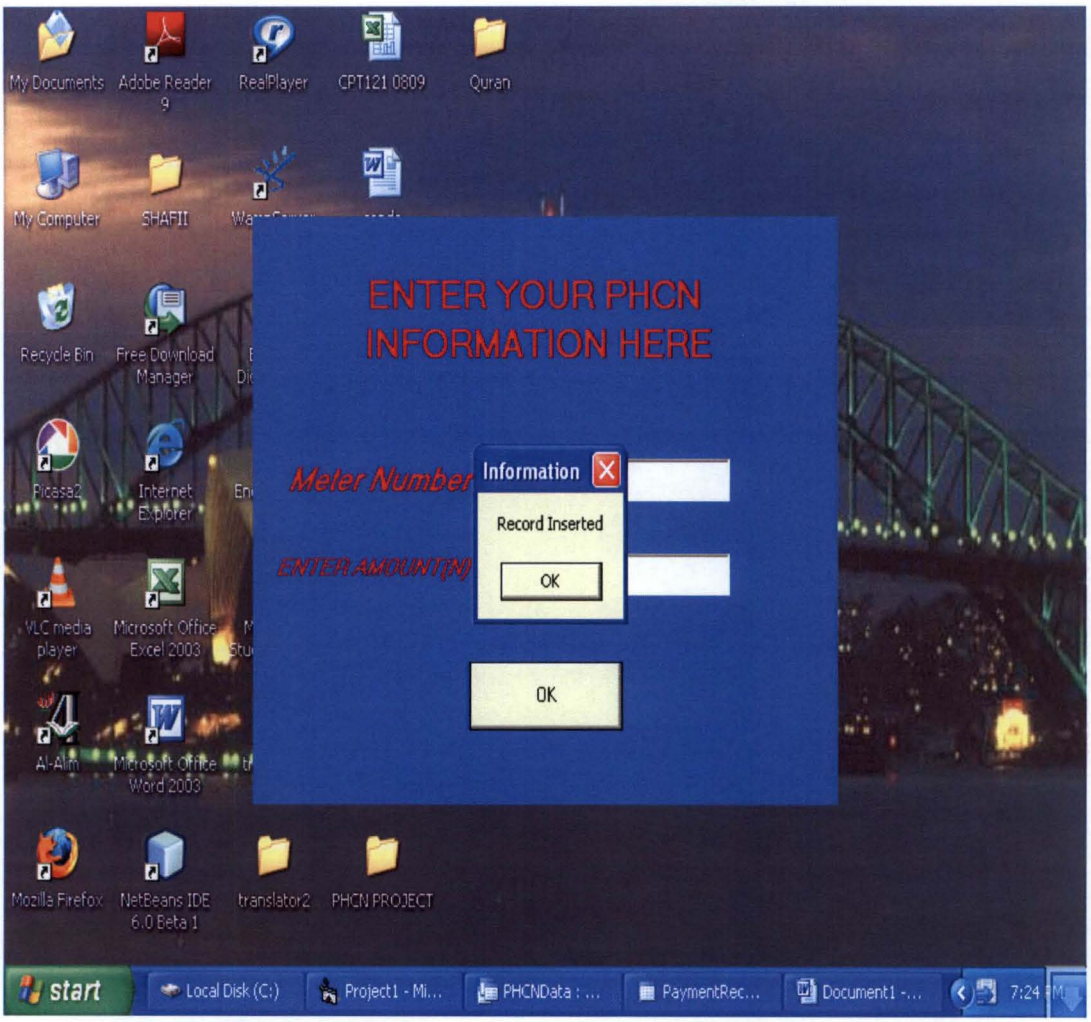

Fig 4.7 Record information Page

Confirmation Interface

This interface enables the user to confirm the Meter number once again. If the wrong meter numbers was entered previously, entering a different Meter number will invalidate the entire process, thereby providing an opportunity to redo the process from the beginning. If the right Meter number that is compatible with the previously input Meter number is entered transaction is completed

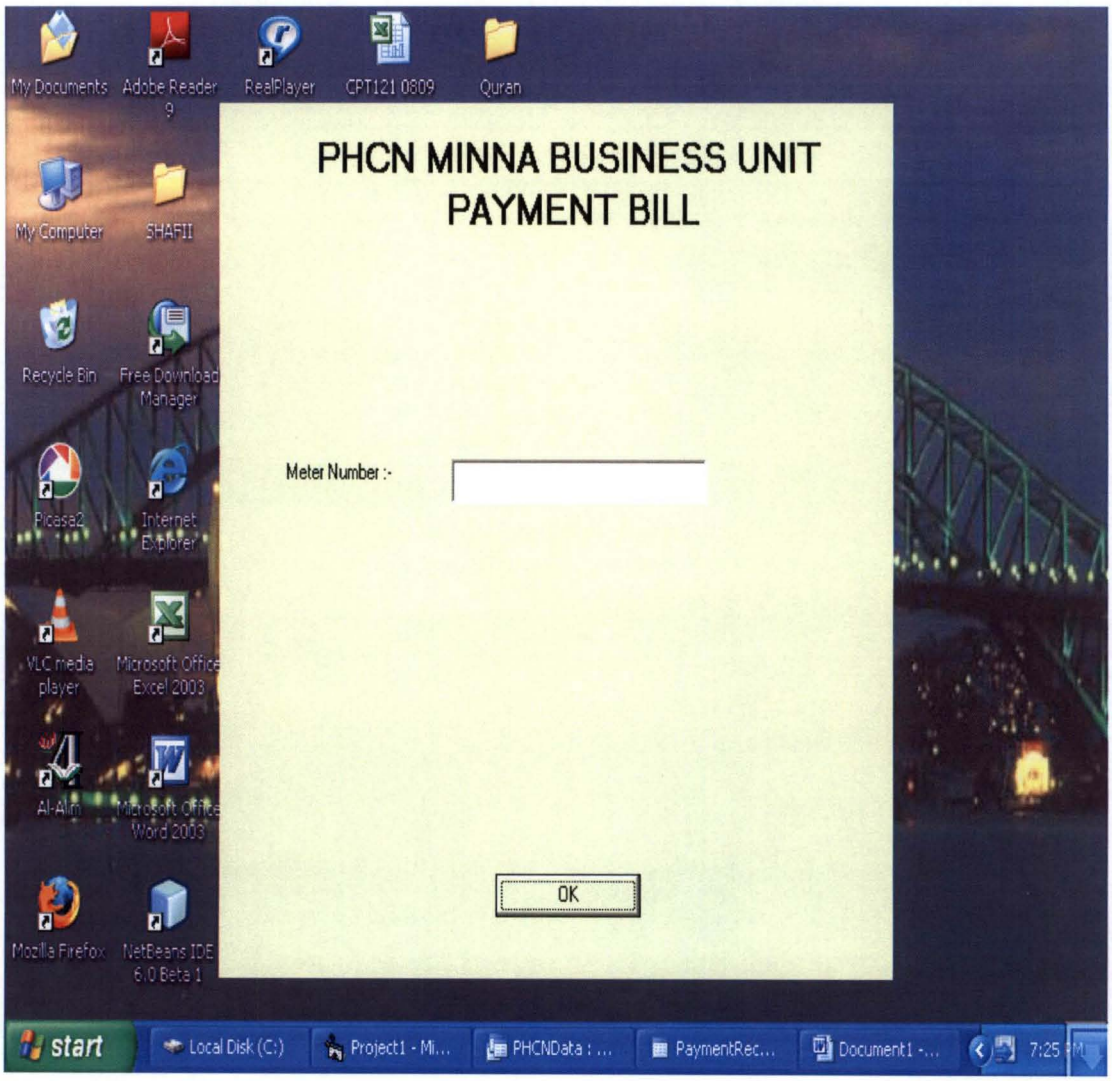

Fig 4.8 Confirmation Interface

Receipt Printout Page

At this stage the system produces the result of the ATM payment transaction in for of a receipt. This receipt is printed by clicking on print button. The printout include Meter Number, Payment date, Previous Balance (amount owed prior to payment), current charges, VAT charges, Total due Now, current payment and Balance. This printout is the evidence of payment. With this you have finished transaction for the payment of PHCN bill, using ATM technology.

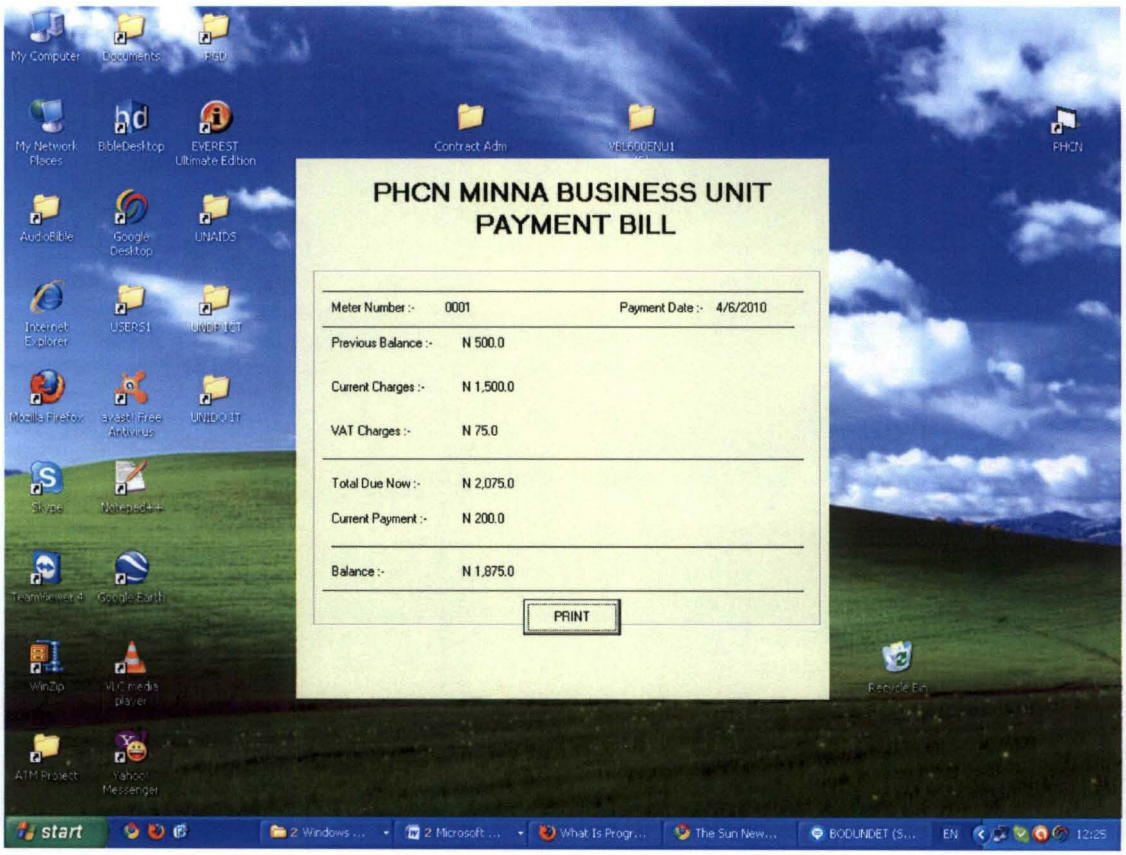

Fig 4.9 Receipt Printout Page

Thank you Screen

This interface indicated that you have successfully paid your bill using your ATM debit card. At this stage you can then remove your debit card when prompted to do so by the ATM machine.

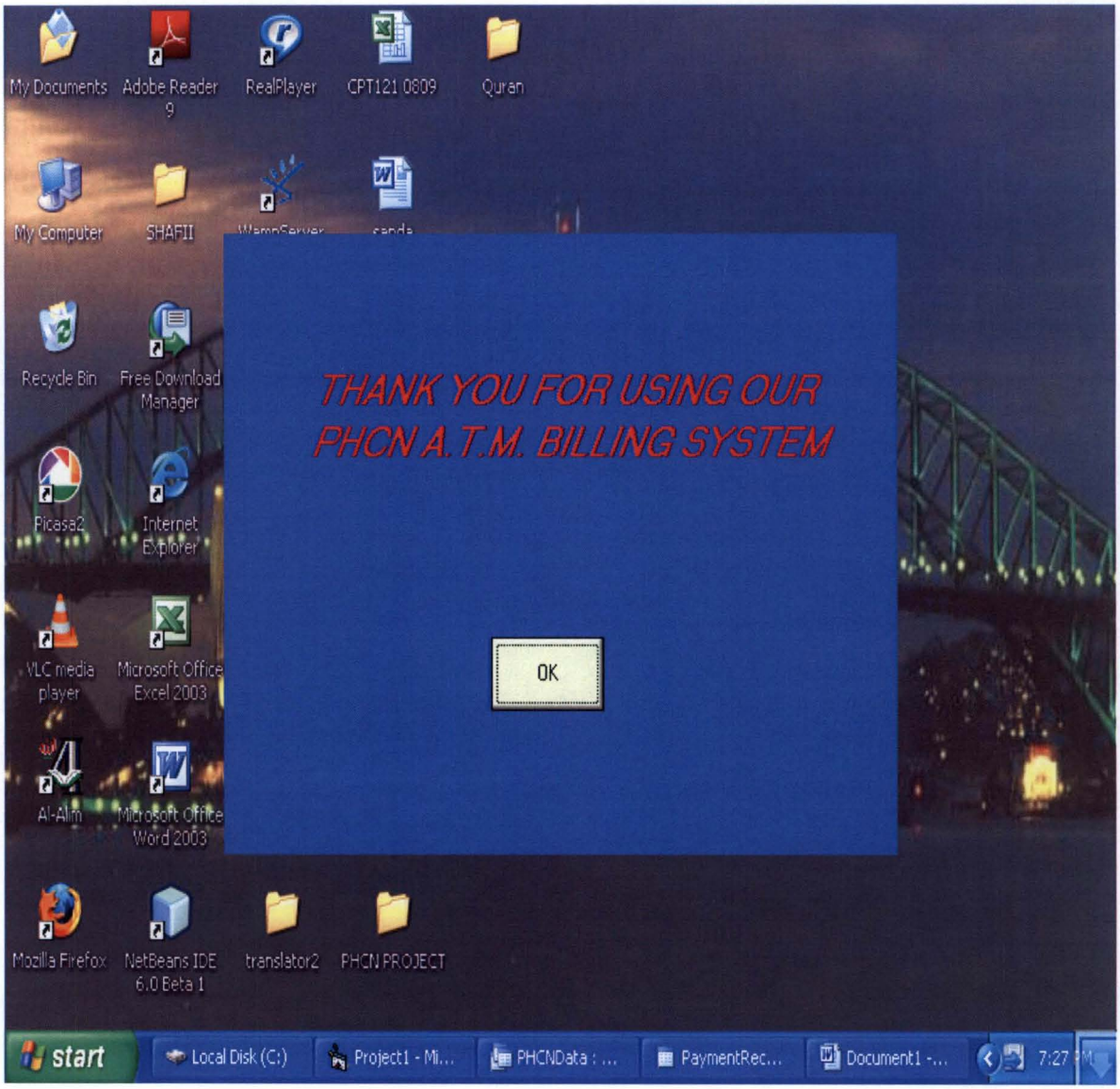

Fig 4.10 Thank you Screen

THE DATABASE DESIGN USING ACCESS

As part of the requirement for the proper functioning of this application, Microsoft Access is used for the backend of this program. The database contains the payment records of PHCN customers.

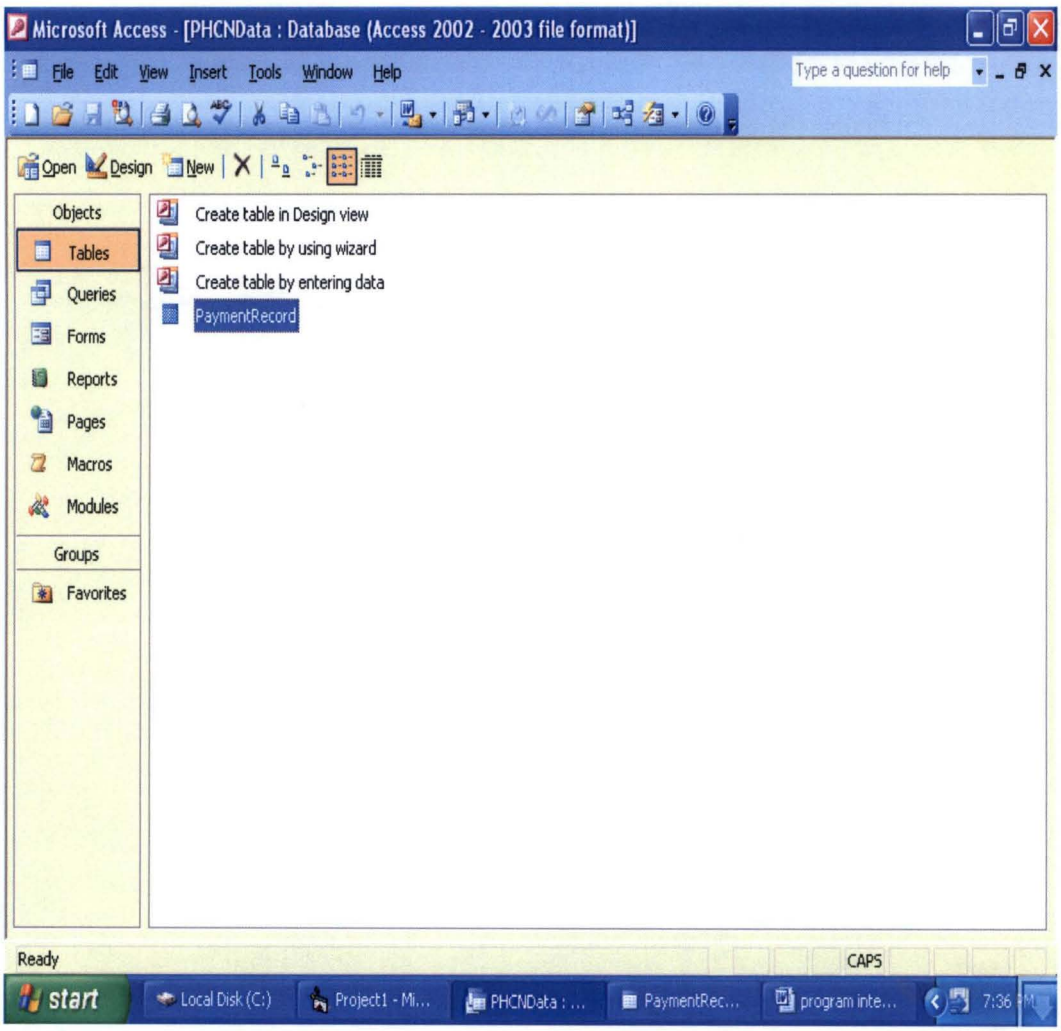

Fig 4.11 Back End Design

Customers' Records

This database should be hosted on the PHCN central server that is link with the ATM service provider and the Banks. It contains all the details of all the PHCN customers nationwide, such that transaction could be carried out at any location, just like that typical use of ATM for cash withdrawal.

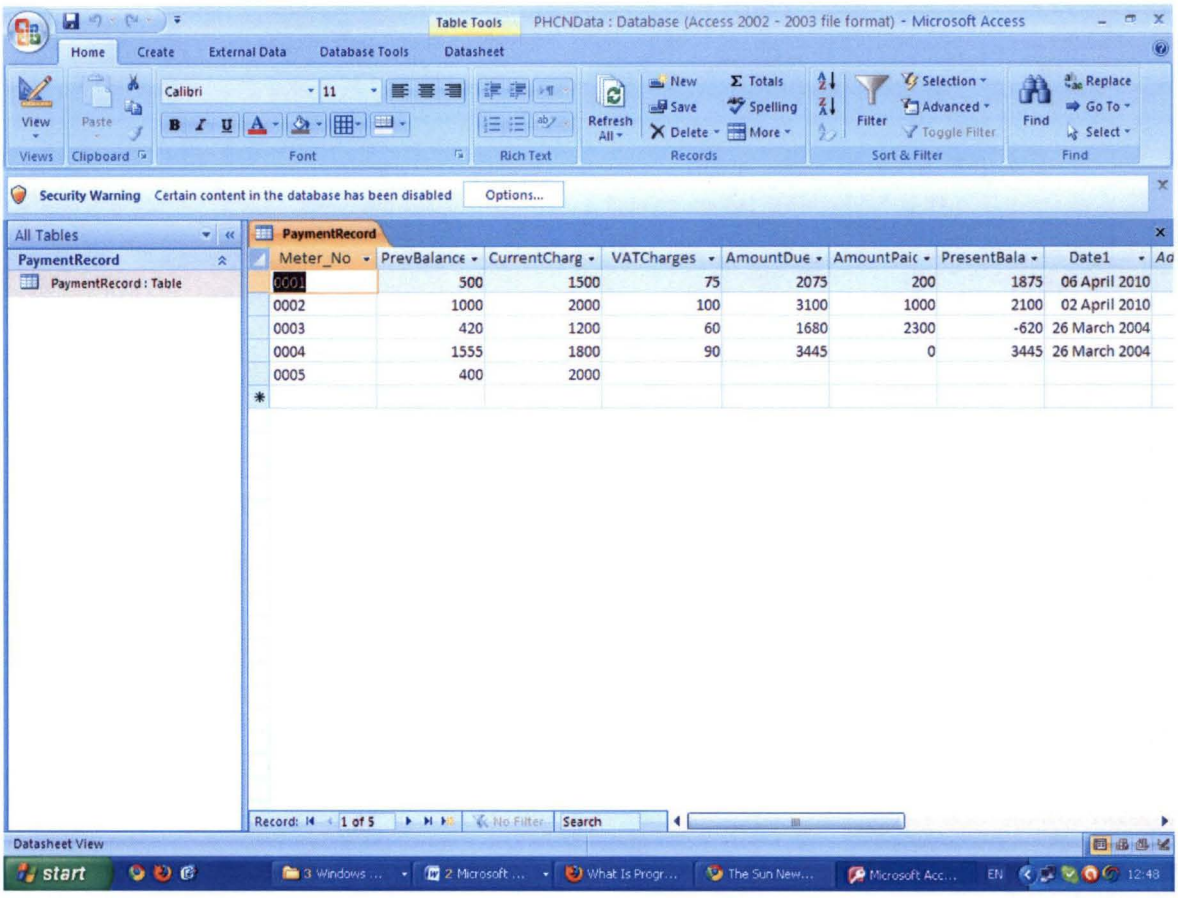

Fig. 4.12 Customers' Database

4.4 Testing and Debugging the System

Debugging is the process of executing a system on a set of artificial data set to detect any faulty result and aim at correcting it.

System testing is an expansive, but critical process that may take as much as fifty percent of the program development resources. The common view of testing is that, it is performed to uncover errors and defaults. Code testing strategy examines the logical aspect of the program while specification testing strategy examines the requirement specifications.

i. **Unit Testing:** This is a debugging process where each module was debugged and tested on a specified set of data to ensure that the modules work as expected.

ii. **Integration Testing:** This process examines the integration of different modules and functionalities of the integrated sub-modules to determine structural weaknesses and remove all anomalies that may affect the system for proper integration.

For this project all the necessary debugging and testing had been carried out and the application so developed is functioning according to desired result.

4.5 Program Documentation.

This involves the records and the details logics and coding of the component program of the system. The program documentation is a kind of documentation that gives a comprehensive procedural description of a program. It shows as to how software is written. Program documentation includes hard-copy or electronic copy that enable users, program developers, and operators to interact successful with a program. These records are prepared by the programmer. It aids in performing general maintenance, troubleshooting and development acceptance. The Programs for this project work is well documented, as could be seen in the Appendix at the end of this project.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The main objective of the project was to demonstrate the use of ATM technology for the payment of bill, using PHCN as a platform. Automated Teller Machine (ATM) payment systems attempt to enhance the easy of payment of bills anytime, and anywhere. With improvement in our Banking consciousness and the availability of ATM machine everywhere, access to remote payment using ATM technology is now a possibility.

The use of ATM payment system will encourage prompt payment of bills. It will also remove the administrative bottleneck associated with traditional modes of payment, including long queue in the Banking halls.

In this project Visual Basic 6.0 is used for the development of Front End application, which created a user friendly Graphical User Interface (GUI), that PHCN customers interact with in the process of conducting transactions. Microsoft Access is used as the Back End database for the purpose of holding the records of PHCN customers.

It is of interest to note that the security of the PIN is a personal responsibility. Your PIN should not be given to a third party and must be guarded seriously, in order to avoid unauthorized use of the debit card by fraudsters.

5.2 Conclusion

It has been demonstrated that an ATM based payment systems is feasible and can be used to enhance efficiency in payment of bills at convenient times. The ability to quickly and easily complete a transaction can be a key to delivering a positive customer experience. The future of ATM payment system appears promising. With the advent of emerging technologies and fast growing access to ATM Machine it is envisaged that most people will embrace the ATM payment system as a better option to manual systems. It seems likely that ATM payment system would increase and become more effective with proliferations of ATM Machine in every nooks and cranny of our society with better management of our Banking systems. This project work developed a prototype of Automated Teller Machine (ATM) enabled payment software for payment of electricity bills to PHCN.

5.3 Recommendations

The objective of the project was achieved: to developed An Automated Teller Machine (ATM) Enabled Payment of PHCN Bills. This project seeks to encourage the use of technology for day-to-day activities. The researcher recommends that this innovation to the use of ATM technology be introduced into our economy. The system developed presents its features in English Language. There is need to develop a system that can be configured for our local languages to ensure nationwide usability. Also, I recommend that the Nigerian population needs to be educated on how to use ATM based payment system technology.

The researcher wishes to note that the project work is a limited prototype, that could be improved upon and deploy for an enterprise-wide usage in our industrial sectors, particularly utility-based industries. So, there is need for further research on the implementation of Automated Teller Machine (ATM) enabled payment application for payment of bills in Nigeria and beyond.

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APPENDIX

PROGRAM CODES

1. WELCOME PAGE

```
Private Sub Command1_Click()
   Unload Me
   pin.Show
End Sub
```

2. PIN CODE PAGE

```
Private Sub Command1_Click()
   Dim entry As String
   entry = Val(Text1.Text)
   If entry = 1111 Then
      Unload Me
      account.Show
   Else
      MsgBox "Wrong PIN Number! Please Re-Enter your PIN"
      Text1.Text = ""
   End If
End Sub
Private Sub Form_Load()
   Text1.Text = ""
End Sub
```

3. ACCOUNT TYPE PAGE

```
Private Sub Command1_Click()
    Unload Me
    operationSAVINGS.Show
End Sub

Private Sub Command2_Click()
    Unload Me
    OperationCURRENT.Show
End Sub
```

4. OPERATIONS PAGE

```
Private Sub Command1_Click()
    Unload Me
    phcn.Show
End Sub
Private Sub EXIT_Click()
    Unload Me
End Sub

Private Sub Form_Load()

End Sub
```

5. PHCN RECORD PAGE

```
Dim PrevBalance1 As Double
Dim CurCharges As Double
Dim VATDue As Double



Private Sub cmdSubmit_Click()



  With Adodc1


    .RecordSource = "SELECT * FROM PaymentRecord WHERE Meter_No ='" +
txtMeterNo.Text + "'"
    .Refresh


  End With


  With Adodc1.Recordset
    PrevBalance1 = !PrevBalance
    CurCharges = !CurrentCharges
    VATDue = 5 / 100 * CurCharges
  End With
  With Adodc1.Recordset
    '.AddNew
    !VATCharges = VATDue
```

```
                !AmountDue = PrevBalance1 + CurCharges + VATDue
        !PresentBalance = PrevBalance1 + CurCharges + VATDue - txtAmount.Text
        !Date1 = Date
        !Amountpaid = txtAmount.Text

        .Update
        .Requery

          End With
    MsgBox "Record Inserted", vbOKOnly, "Information"
    Unload Me
    PaymentBill.Show

End Sub

Private Sub Form_Load()
    With Adodc1
          .ConnectionString = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=C:\PHCN
PROJECT\PHCNData.mdb;Persist Security Info=false"
        .RecordSource = "SELECT * FROM PaymentRecord WHERE Meter_No ='" +
txtMeterNo.Text + "'"
        .Refresh
          End With

End Sub
```

6. PHCN BILL PRINTING PAGE

```
Private Sub cmdOk_Click()

Label9.Visible = False
txtMeterNo1.Visible = False
Frame1.Visible = True
lblMeterNo.Caption = txtMeterNo1.Text

With Adodc1

  .RecordSource = "SELECT * FROM PaymentRecord WHERE Meter_No ='" + txtMeterNo1.Text
+ "'"
  .Refresh

End With

With Adodc1.Recordset
  lblVAT.Caption = "N " & Format(!VATCharges, "###,###.0#")
  lblTotalDue.Caption = "N " & Format(!AmountDue, "###,###.0#")
  lblBalance.Caption = "N " & Format(!PresentBalance, "###,###.0#")
  lbldate.Caption = !Date1
  lblCurrentPay.Caption = "N " & Format(!Amountpaid, "###,###.0#")
  lblPreBalance.Caption = "N " & Format(!PrevBalance, "###,###.0#")
    lblCurrentCharge.Caption = "N " & Format(!CurrentCharges, "###,###.0#")
```

```
    cmdOk.Visible = False
    cmdPrint.Visible = True

  End With


End Sub

Private Sub cmdPrint_Click()
  Unload Me
  thanks.Show

End Sub

Private Sub Form_Load()
  cmdPrint.Visible = False
  With Adodc1

    .ConnectionString = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=C:\PHCN
PROJECT\PHCNData.mdb;Persist Security Info=false"
    .RecordSource = "SELECT * FROM PaymentRecord" 'WHERE Meter_No ='" +
txtMeterNo.Text + "'"
    .Refresh
      End With
End Sub
```

7. EXIT PAGE

```
Private Sub Command1_Click()
   Unload Me

End Sub

Private Sub Label1_Click()

End Sub
```