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Proposed algorithm for automated teller machine

Essien Eyo E
Dept of Maths / Stats & Computer Science, University of Calabar.

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ABSTRACT
Since the introduction of Automated Teller Machines (ATMs) in Nigeria, cash handling has really reduced especially for those who live in the city and have easy access to ATM machines by means of their ATM cards. People no longer see the needs to carry excess cash at home when they already have an ATM card since ATM machines can be easily accessible. ATM operation did not turn out to be all rosy as it started out. This research surveys ATM malfunctions in four states in Nigeria to ascertain the nature of malfunction that is prevalent and formulates a modification algorithm/routine that should possibly correct this ATM misfit.

Introduction

An automated teller machine (ATM), is a computerized telecommunications device that provides the clients of a financial institution with access to financial transactions in a public space without the need for a cashier, human clerk or bank teller. ATMs are known by various other names including automatic banking machine, cash machine, and various regional variants derived from trademarks on ATM systems held by particular banks. On most modern ATMs, the customer is identified by inserting a plastic ATM card with a magnetic stripe or a plastic smart card with a chip; that contains a unique card number and some security information such as an expiration date or CVVC . The card security code (CSC), sometimes called Card Verification Data (CVD), Card Verification Value (CVV), Card Verification Value Code (CVVC), Card Verification Code (CVC), Verification Code (V-Code), or Card Code Verification (CCV). Authentication is provided by the customer entering a personal identification number (PIN).

According to the estimates developed by ATMIA (ATM Industry Association), the number of ATMs worldwide in 2007 was over 1.6 million. As the ATM networks expand it is very important that the proper monitoring, supervision and cash management of the ATM networks to put in place (Snellman , Viren, 2006). Very important element in the development of efficient ATM network management system is supervision of the daily cash withdrawals of ATMs and detection of unexpected behaviour of the specific ATMs. Supervision of the ATM network has to be created based on historical daily cash withdrawal data. The unexpected behaviour of an ATM can emerge from different reasons, e.g., it can be bundled with some rising obstacles in the ATM environment, with the operational problems of the ATM, or with clients' illegal actions. It is important to note, that for the identification of the unexpected behaviour of a specific ATM it is necessary to compare the ATM's behaviour with the behaviour of similar ATMs in the neighbourhood. If for some reasons (weather conditions, events in the region, etc.) disturbances are common for all ATMs in neighbourhood, then the changed behaviour of the specific ATM hasn't to be interpreted as unexpected. For the banking institutions it is crucial to identify the unexpected behaviour of an ATM as quick as possible and then act adequately to solve these problems timely. Because of the size of the ATM networks (some service institutions maintain ATM networks with over 1000 ATMs in network) human operators can't supervise efficiently the functioning of all ATMs. Therefore automatic procedures for detection of the unexpected behaviour of the ATMs have to be employed. In the paper (Simutis et al, 2009) there is proposed principal component analysis (PCA) methods for detection of the unexpected behaviour of the ATMs. The unexpected behaviour of specific ATM was detected using PCA models of ATMs, joined in special ATM cluster. When the correlation models of the ATMs' cluster had given large prediction error an unexpected behaviour of the specific ATM was declared. Unfortunately, this approach isn't accurate enough, when the correlations between the cash withdrawals of specific ATMs in ATM cluster are nonlinear. Rimvydas et al (2009) proposes an improved solution for this task, where nonlinear correlation models for describing of ATMs' daily money withdrawals were used.

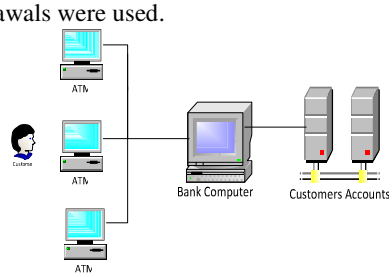

Figure 1: A practical ATM Network

Motivation

Nowadays, ATM is increasingly generally referred to as Automated Thieving Machines due to the somewhat deceptive manner in which the machines tend to behave when bank customers want to withdraw their hard earned money. Imagine putting in your ATM card into the machine in order to withdraw N10,000 only for the card to be returned to you and yet you receive a debit text message on your phone without cash ever

Tele:
E-mail addresses: essieneyo@gmail.com, essieneyo@in.com

coming out of the machine. There have been times when customers equally withdraw with the ATM card but instead of the so called smart machine to do a single debit, it debits you twice and at times thrice. So what do you do next? You take a short break from work the next day to go to your bank in order to fill an ATM complaint form but in the end, they practically do nothing about it. You find out that each time you go to the bank to make a complaint or follow up on an earlier complaint; they tell you that they are working on it while at the same time wasting your time and money.

Several Nigerians complain about ATM trapping their card, not dispensing cash but assuming completion of transaction. At times the customers have to wait as long as three weeks to one month before the operation is reversed; after laying complaints. The ATM was designed to reduce the pressure in the banking hall and provide quick cash withdrawals in times of emergency. If these services cannot be satisfied at the time its being needed, then the purpose is defeated.

Also, assuming at the time of the recorded false transaction, the last money in the account was deducted; this will lead to unsatisfied service to the customer and can be very annoying. This research therefore suggests a workable algorithm that can resolve the issue of wrong cash deduction.

Survey of ATM Malfunction in Nigeria

A survey of ATM operation complains was captured in four states in Nigeria to ascertain the need for ATM operation review in Nigeria and to determine the nature of ATM malfunction that is prevalent.

A questionnaire was prepared that captured various ATM malfunction complains grouped into four:

i. Delayed Cash: The ATM ejects card after transaction without dispensing cash.

The cash comes out after sometime 10, 15 minutes, when the customers must have left the banking premise mostly. In this case the security is normally alerted so that he will be in the look out.

ii. Cannot dispense cash: During transaction, when the customer must have entered the amount to be withdrawn, the ATM gives the error message “cannot dispense cash” and then ask you for the next transaction.

iii. Trapped card: This happens when the customers card is trapped in the ATM.

iv. Over billing: This happens when a double or triple debiting is done in a customers account for one withdrawal transaction.

The questionnaires were distributed only to those that had ATM malfunction experiences in the year 2010.

Two hundred questionnaires were completed at each state of observation; so that the observation can be even. The following table and graph show a summary of my findings:

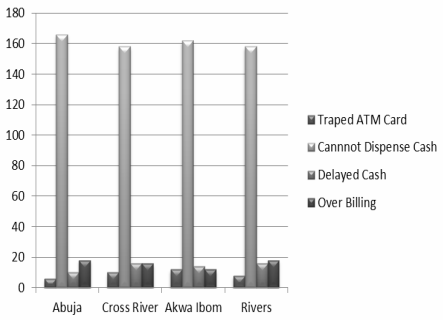

Figure 2: Summary of Observation in each State.

From the above summary, it can be seen that the prevalent issue is being debited without dispensing cash.

Possible Causes of ATM Malfunction Cases

Possible cause of abnormal ATM functions in the light of the above groupings are discussed below:

Delayed Cash:

i) The sudden cut in power supply at the time the ATM is about to dispense cash can cause the suspension of the action. When the power is restored, the first action of the ATM is to eject the card before dispensing the cash if it will.

ii)The cash dispensing mechanism might be faulty to cause a delay in action.

iii) The algorithm/routine is inadequate to check this misfit and assume appropriate action.

Cannot dispense cash:

i) There are no cash in the ATM.

ii)The cash denominations are not fixed into their appropriate cassette so that the machine gets stock at the point of dispensing cash.

iii) The cash dispenser is faulty

iv) The algorithm/routine is inadequate to check for these errors and recommend appropriate action(s).

Trapped card

i) The customer entered a wrong pin three times.

ii)Sudden power failure

iii) Malfunction of card ejection system

Over billing

i) The algorithm/routine is inadequate to recheck such transaction.

Proposed Solution

This proposed solution will provide a modification in areas that the existing ATM algorithm/routine has defects in addition to the following suggestions.

Delayed Cash:

i) Relying on the system operation log, strict recording of step by step operations are recorded so that the system can recover from power failure from these logs.

ii)The cash dispenser is checked for error before any cash withdrawal transaction.

Cannot dispense cash:

i) The amount of cash in ATM is checked before any debit transaction is allowed.

ii)The cash dispenser is checked for error before any cash withdrawal transaction.

Trapped card

i) Relying on the system operation log, strict recording of step by step operations are recorded so that the system can recover from power failure from these logs.

Over billing

i) At the end of each day’s transaction, the ATM account should be checked against the ATM system log.

ATM Algorithm

Assumptions: For purpose of our study, the following variables are defined as follows:

k is the maximum withdrawal permitted per day.

m is the maximum withdrawal allowed per transaction

n is the minimum cash in the ATM to permit a transaction

t is the total fund in the ATM at start of day .or at any time.

Pcount is the counter for ATM pin attempts

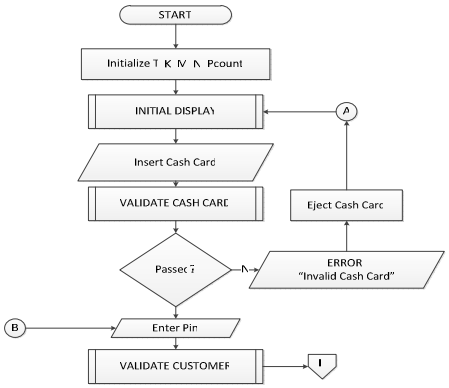

Figure 3a: Workable Algorithm of ATM – part 1

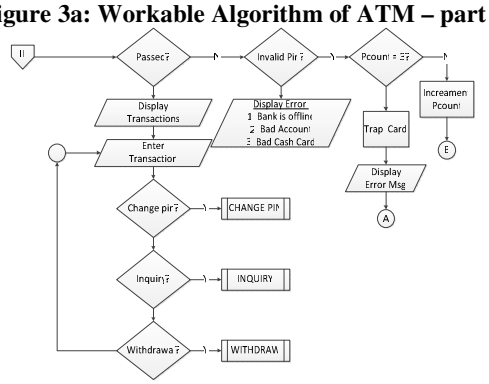

Figure 3b: Workable Algorithm of ATM – part 2

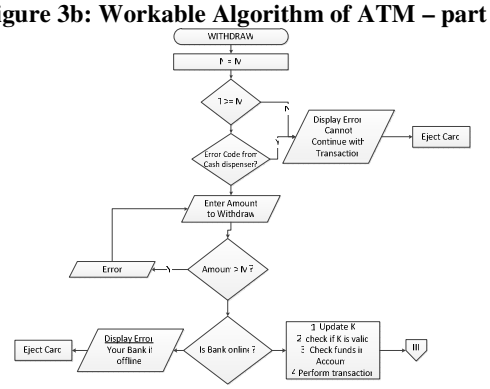

Figure 3c: Workable Algorithm of ATM – part 3

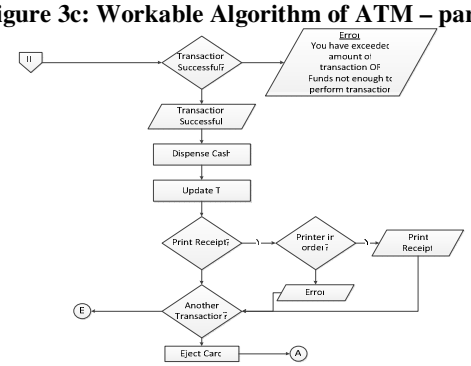

Figure 3d: Workable Algorithm of ATM – part 4

Simulation

The above algorithm was modeled in a simulator and transaction for five thousand customers was checked by means of random input generation. The result of the simulation is given in the graph below:

Discussion

With the implementation of the above algorithm, the ATM error operation is reduced to trapping of cash card if the card is invalid or the customer enters a wrong pin 3 times. The other malfunctioning errors; like cannot dispense cash, etc. is completely eliminated.

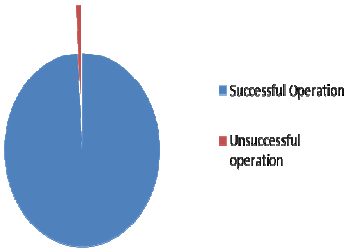

Figure 4: Simulation result

Summary

The software should support a computerized banking network. Each bank provides its own computer to maintain its own accounts and process transactions against them. Automated teller machines communicate with the banks' computers. An automatic teller machine accepts a cash card; interacts with the user, communicates with the bank computer to carry out the transaction; dispenses cash and prints receipts. The system requires appropriate record keeping and security provisions. The system must handle concurrent access to the same account correctly. The banks will provide their own software for their own computers. The cost of the shared system will be apportioned to the banks according to the number of customers with cash cards.

Conclusion

The ATM network has to provide software interfaces to the software used by different banks and different network software. Also there should be no restriction of the ATM network to a specific network protocol as long as the performance requirements are satisfied. Other performance requirements may include:

1. Error messages should be displayed at least 30 seconds each time.
2. If there is no response from the bank computer after a request within 2 minutes, the card is rejected with an error message.
3. The ATM dispenses money if and only if the withdrawal from the account is processed and accepted by the bank.
4. Each bank may be processing transactions from several ATMs at the same time.

Reference

1. ATM Forum, www.atmforum.com. ATM Forum, Worldwide Headquarters, Mountain View, CA 94040-1313
2. ATM/HFC Network Simulator, Operation and Programming Guide, Ver 4.0, N. Golmie, F.
3. ATM Angles for IP Edge, D. Pappalardo, Network World, 16, 7, 1999, pp 1 and 61.
4. High Performance Communication Networks, J. Walrand, P. Varaiya, Morgan Kaufman, 1996
5. Haykin, S. Neural Networks. A Comprehensive Foundation. Prentice Hall, 1999.
6. Kramer, M. A. 1991. Nonlinear principal component analysis using autoassociative neural networks. AIChE Journal 37: 233–243.
7. Mouveaux, et.al., U.S. Department of Commerce, Technology Administration, National Institute of Standards and Technology, Gaithersburg, MD 20899, December, 1998
8. Rimvydas Simutis, Darius Dilijonas, Lidija Bastina 2009. Enhanced supervision of automatic teller machines viaautoassociative neural networks. Applied Stochastic Models and Data Analysis"(ASMDA-2009) , Vilnius, LITHUANIA.

9. Source Behavior for ATM ABR Traffic Management: An Explanation, R. Jain, et. al., IEEE Communication Magazine, 34, 11, pp 50-57, 1996.
10. Snellman, H.; Viren, M. ATM networks and cash usage. Research Discussion Papers Bank of Finland, Nr. 21, 2006, p. 1–33.
11. Simutis, R.; Dilijonas, D.; Bastina, L. 2009. Identification of unexpected behavior of an automatic teller machine using principal component analysis models (submitted for publication).
12. Simutis, R.; Dilijonas, D.; Bastina, L. 2008. Cash demand forecasting for ATM using neural networks and support vector regression algorithms // EurOPT' 2008, May 20-23, 2008, Neringa, Lithuania: selected papers. Vilnius. p. 416–421.

Table 1.1: Summary of Observations in each State

Issues\ State	Abuja	Cross River	Akwa Ibom	Rivers
Traped ATM Card	6	10	12	8
Cannnot Dispense Cash	166	158	162	158
Delayed Cash	10	16	14	16
Over Billing	18	16	12	18