EXPLOITING GENETIC ALGORITHM IN STRING CASH DISPENSE DISPUTE

Aru, O. E., Adimora, K.C. and Nwanebu, O. T.
Department of Computer Engineering,
Michael Okpara University of Agriculture Umudike, Umuahia Abia State, Nigeria
okezearu@gmail.com and kyrimanjero@gmail.com

ABSTRACT

The cash transaction dispense dispute seems to be an ugly daily experience to bank customers. Most times the customers' debited funds would not be auto reversed within the 24 hours given by inter-switch. At this point, customers have to report officially to their banks to get the problem sorted out manually by filling the dispute form. In some cases, after filling the form, they have to wait for at least seven business working days before the un-dispensed debited funds are reversed. This might be very excruciating on the customer, especially when un-dispensed cash is the only money on him/her. In this paper, our core interest is to solve the problem of delay in reversing debited funds using a genetic algorithm approach based on numerical integration. The result of the new system revealed how dispensed disputes are resolved within seconds without delay using the optimal fitness function values of the genetic algorithm that validates the customers' claims and makes refunds. The system is independent of inter-switch and its flexibility allows customers to report their dispensed dispute online, especially when it is not reversed within allotted seconds. The research paper data set and the results were tested and analyzed using MATLAB software application.

KEYWORDS: Cash Transaction, Dispense Dispute, Genetic Algorithm, Fitness Function, Numerical Integration.

INTRODUCTION

The design and development of the proposed intelligent data logging system for managing unsuccessful cash transactions of bank customers in Nigeria is the core aspect of this study. The proposed system will operate separately and not rely on inter-switch like the current system does while resolving un-dispensed debited cash disputes. Also, the system is structured to deliver services in microseconds, unlike the current system that gives 24 hours before the debited cash is auto reversed. The proposed system is computerized and automated in nature, that even if the unsuccessful debited cash was not reversed within the stipulated seconds, it will allow the user to report the cash transaction online and have a positive response immediately from the customer's care provided the claims are correct and not beyond the allowable iteration. Although this can only occur in 1 out of every 100 transactions when the new system is in use. This function of the proposed system solves the problem of queuing up in the banking hall as observed by the current system for manually filling cash dispense dispute forms. The proposed system allayed the fear of one losing his /her debited money in a failed transaction. This is because with the proposed system every debited dispense error, must be reversed within few seconds without any delay.

In the proposed system development, we often mention these terms, time of cash transaction f(t), amount of Cash transaction f(C_a), and the location of the transaction f(L). These parameters were used to formulate some mathematical principle unto which the new system is built. Equation (1) and (2) have these parameters defined in them.

Let a function f (t) be defined on a segment [Ca, L, t]. It is required to calculate and generate a definite integral T of the cash transaction function f(t) over the segment [Ca, L, t] of the un-dispensed debited cash dispute which is stated thus: $T = \int_i^n f(t)f(L)f(C_a)dt$ (1)

Let $C_a = \{ t_0, t_1, t_2, \dots t_n\}$ be a cash transaction of the segment [t, n].

It is assumed that amount transacted $a = t_0 < t_1 < \cdots < t_n = L$.

$The\ node\ t_0, t_1, t_2, \dots, t_n\ of\ transaction\ C_a\ subdivided$

$the\ segment\ [t, n]\ into\ n\ small\ segments$

$[\, t_0, t_1], [t_1, t_2\,], [t_{n-1}, t_n] so\ that\ t_i - t_{i-2} = \frac{L-a}{n}\ for\ all\ \ i = 1$

According to the additive property of definite integrals we have the equality of successful and unsuccessful debited cash transactions represented in the proposed data logging system model.

$$\int_t^n f(t)f(C_a)f(L) = \sum_{i=1}^{n} \iint_n^a f(t)dt$$

(2)

A typical dispense error life cycle of the proposed system is shown in Figure 1.1.

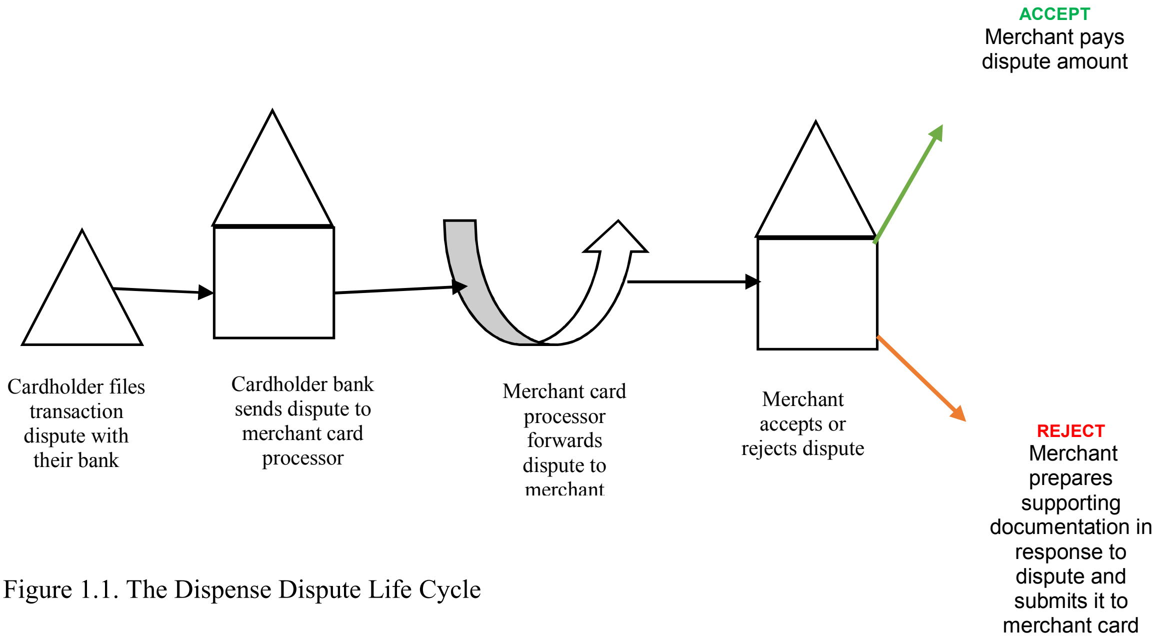

Figure 1.1. The Dispense Dispute Life Cycle

The delay in reversing debited fund is due to the total dependence on the inter-switch platform communication. However, in order to solve this prominent problem, we proposed an intelligent data logging system (IDLS), software-based for each financial institution to enable them internally resolve dispense errors without depending on the inter-switch service alone. In fact, this is the core area of interest that gave rise to writing this article paper. We have the confidence that once the proposed IDLS system is accepted, implemented, and deployed into operation the customers' complaints about their ugly experiences with respect to dispensing dispute and delay in reversing unsuccessful cash transactions debited funds will either be the things of the past or completely curbed.

Related Work

There are many research scholars who have worked on issues related to cash transactions and fund transfers. Electronic funds transfer (EFT) is an electronic transfer of money from one financial institution to another, either within a single bank or across multiple institutions, via computerized systems, without the direct intervention of bank staff. The electronic fund transfer uses different financial transaction platforms such the Point of Sale (POS), Automated Teller Machine (ATM), Mobile Transaction, and Internet Banking. Each of these platforms has relieved customers from the stress of queuing up in the banking hall for a cash deposit, bill payment, and other bank activities. The fund transfer can be for direct deposit payment, direct debit payment, wire transfer, or electronic bill payment as shown in Figure 1.2. The aforementioned platforms of financial transactions are most times encountered what is known as "Dispense Error (DE)". The dispensing error is a situation where transactions were unsuccessful and the transaction initiator is debited in error.

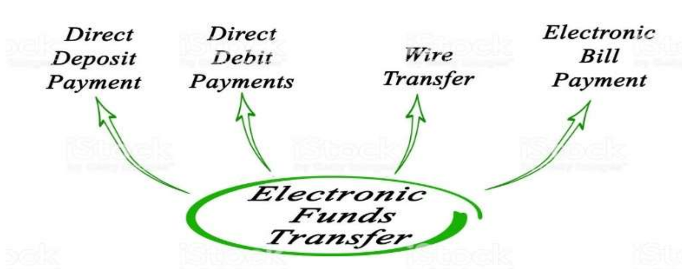

Figure 1.2. Electronic Fund Transfer

$$Dispensed\ Error(DE) = Failed\ Transaction\ (Ft) + Debited\ Fund\ (DF)$$

Sujata (2018) research on the Automated teller machine (ATM) monitoring process to maximize the availability of an ATM fleet for the bank customers and reduce the downtime caused by various issues.

Vladimir (2013) a conducted experiment that genetic algorithms can be used successfully in problems of definite integral calculation, especially when an integrand has a primitive which can't be expressed analytically through elementary functions.

Ramakalyani (2012) research with the increased use of credit cards for online purchases as well as regular purchases, causes credit card fraud.

Ahmadreza (2014) conducted research on the use of Automatic Teller Machine (ATM) to pay bills, transfer funds, and withdraw cash based on a genetic algorithm to determine the replenishment cash strategy for each ATM.

Gupta (2009) research work to solve the mixed-integer constrained optimization problem with interval coefficient by real-coded genetic algorithm with ranking selection.

Mohammed (2014) research on the advent of ATM its benefits and challenges due to non-refund system for failed bank transactions. The research focused mainly on a non-refund system without much emphasis on the time frame the failed transactions can be refunded.

According to Fatai *et al.* (2014), research a study that revealed how significantly the use of ATM has reduced queues in the banking hall.

Materials and Methods

The proposed system will be designed using the methods and materials discussed below.

Materials

The materials used for the development of the new system are;

I. Relevant Literature review
II. Laptop computer System
III. Windows Operating System
IV. Visual Studio IDE for coding
V. Questionnaire for data collection
VI. Matlab IDE software application for result testing and validation.

Methods

A Numerical Integration Method

The Genetic Algorithms based on the Numerical Integration approach are deployed in the development of the proposed system. In order to gain some insight into how the proposed system is designed and operated. We formulated a mathematical framework based on genetic algorithms and numerical integration that can be viewed as an approach for approximating integral values of the bank customers' cash transactions. In the research design, we assume that $C(t) is\ a\ bounded\ function\ defined\ as\ \int_n^l C(t)\,dt$ on [L, n] and that $\{T_0, T_1, \dots T_n\}$ denoting the type of transaction platform onto which the transaction activity was carried out with the exact amount transacted.

$$C_i(t) = Sup \int f(t) \int f(L) \int f(n) \int f(ID) \int_{account\ Number(m)}^{Account\ Name(x)} f(ID) \sum_i^M A\ Transacted$$

Where $C_i(t)$ is the cash transaction C_i with respect to time(t), $f(t)$ is the function that represents the exact time the unsuccessful debited funds were transacted, $f(L)$ is the function that calculates the location at which un-dispensed debited funds were transacted, $f(n)$ is the function that determines the number of times (transaction attempts) the transaction process was carried out, $f(ID)$ is the function that gives the identity of who was involved in the unsuccessful cash transaction, A is the amount transacted. The upper boundary value M in the summation symbol is the allowable maximum cash transaction in a day (iteration) while i is minimum cash transactions in a day.

Therefore, for proper account holder system identification on record repository, we have the model developed thus:

$Letting\ \Delta x_n = x_i - M_x + x_{n-2} - 1$, the upper sum of $f(ID)$ with respect to the Transaction T is defined considering the delay of reversal $\sum Delay$ on average transaction per person.

$$Average\ Transaction\ per\ Person = \frac{1}{f(n)} \sum Delay$$

$$\sum Delay = S_n = \frac{1}{2} n(A + f(L))$$

Any time the above simulation model formulated for delay, get a genetic algorithms' fitness function values less than zero (0) that means un-dispensed error in cash transactions will be reversed within seconds and immediately. However, whenever, the value becomes positive or greater than zero, the debited funds in the failed transaction will be delayed and most times will not be reversed at all once the customer is invalidated.

$$A(M,T) = \sum_i^n M_i\, \Delta_t \Delta_{xn-1}$$

$while\ the\ lower\ sum\ of\ f(n) with\ repect\ to\ the\ transaction\ T\ is\ defined\ as$

$$L(f(L),T) = \sum_{i=1}^{n} M_i \; L_t\Delta_t\Delta_{xn-2}$$

The the upper integral of $f(ID)$ *on* $[L,t]$ *is defined as*

$$Af(T_{n+}i) = \inf(A(n)(ft,T) - M_{x*T_n}$$

and the lower integral of $F(L)$ *is defined as mathematically described below.*

$$L(f(t)) = Sup\;(L(f(t),T) + M^{T+x-n}$$

where both the maximum and minimum transactions are taken all over the possible transactions, T, of the interval [L, t]. If the upper and lower integral of $f(t)$ are equal to each other, their common value is denoted by $\int_x^y f(t)dt$ *and is referred to as Genetic Algorithms integral of* $f(t)$ *provided the right* $f(ID)$ is obtained at the transaction location L.

B Gradient Cash Transaction Method

The Maximum Transaction $MT = M_t \sum_i^n (C_t, L)$

(3)

Subject to $A > 0$ *and number of attempted transactions* n_{at} *which is an integer value.*

Maximum Unsuccessful Dispense (M_{uD})

$M_{ud}(C_t, L)$ *subject to* $A \geq \sum_{i=1}^{n}(C_{t-2} * n)$

(4)

and i is the start of the transaction, while n is the number of times the transaction was carried out (iteration). The interval objectives are the nonlinear transaction problem.

Therefore, it is noted that the solutions of the unsuccessful transaction problem that must be reversed as stated in a cash transaction equation analysis (3) and (4) above are not the optimal solutions of the proposed data logging system for managing un-dispensed debited cash dispute.

The optimal solution with the generic algorithm application can be realized by choosing the best solution from the cases presented below.

$$\frac{Max.transaction\; M_t \sum f(C_y, L^n)}{Max.Unsuccessful\; Dispense\; M_{uD}(C_t, L^k)} * \sum_{i=1}^{n} F(t) f(C_t, * n)$$

(5)

Now, we have to solve the nonlinear cash transaction problem related to un-dispensed debited funds. Mathematical equation (3) and (4) are expressed with interval objective. Generally, cash transactions dispense errors with continuous reversal delay variables are solved by different numerical integration methods. However, handling both successful and unsuccessful cash transactions with interval objectives, is complex and rather difficult to solve the problems of equations (3) and (4) by genetic algorithms methods. Hence, in this study, we shall develop an advanced genetic algorithm for solving un-dispensed cash transaction debited problems with interval objectives involving stalagmite function.

C Genetic Algorithm Modeling Method

Step 1: Cash transactions variable declaration and initialization of Genetic Algorithm

Step 2: Definition of bounds of parameters of the proposed data logging system with GA

Step 3: $n_t = 0$ [n_t represents the number of transactions of current generation]

Step 4: f(t) initialization [f(t)represents the population time of the generation]

Step 5: *Evaluate* $f(t)$

Step 6: *Calculate the time of cash transaction* $f(t)$

Step 7: $t = cash\ transaction\ (ct) * Machine(M)$

Step 8: *Determine the transaction location* $f(L)$

Step 9: *if transaction time* $f(t)\ != $ *the claimed location* $f(L)$ *go to step* 6

Step 10: *if* $(f(n) >$ *maximum generation number) go to step* 12

Step 11: *Select* $f(C,L,t)$ *from* $F(C-1, L-1, t-1, A)$ *by ranking selection process*

Step 12: *Alter* $f(t), f(C_t)$ *and* $f(L)$ *by crossover and mutation process*

Setep 13: *Evaluete* $f(t), f(C_t)$ *and* $f(L)$

Step 14: *Calculate the best* $f(t)$ *andAmount* $f(A)$ *transacted*

Step 15: *Compare* $f(C,L,t)$ *and* $f(C-1, L-1, t-1, A)$ *and accept better one*

Step 16: *reverse the debited Amount* $f(A)$

Step 17: *Go to step* 6.

Step 18: *Print the result.*

Step 19: *Stop*

The various stages and steps of the genetic algorithm design in string cash dispense dispute are described as follows: Implementing the above Genetic Algorithm principle with respect to solving the cash transaction dispenses disputes problem, with the designed interval objectives of the numerical integration model, the following definition these Genetic Algorithm components are considered.

- Selection Process
- Chromosome representation and initialization of population.

- Evaluation function
- Crossover and Mutation
- Fitness Function (FF)

The Maximum transaction Limit (ML) of daily cash transactions, together with transaction Location (L) of transaction , time of transaction (t) are the important parameters by which the genetic algorithms population size , selection, generation, crossover, mutation and fitness function are formulated. In this study, the formulation of the genetic algorithms chromosome was done with the daily, weekly, and monthly collated data (records) of bank customers. The value of the formulated chromosome is assumed to be nonlinear containing both discrete and continuous variables, structured into a matrix of a real number which represented the cash transaction taken to be the data logging system's chromosome. A row matrix $C_a = [\, C_{ai-j}, C_{aj-n}, C_{n+i-j}]$ is used as a chromosome where the vector components $C_{ai-j}, C_{aj-n}, \, and \, C_{n+i-j}$ represent the decision variable and condition for un-dispensed debited cash reversal.

$$Cash\ Reversal = \frac{reversing\ Debited\ Cash\ (R_{DC})}{Not\ reversing\ debited\ cash\ (R_{nDC})} * 100\%$$

Immediately each chromosome is formulated, it is selected and initialized. Next the population size for each defined chromosome is randomly generated within the bounds of the decision variables of the cash transaction stated above. On evaluation the potential population solution is got to determine how best it will solve the un-dispensed debited funds through the use of the genetic algorithm fitness function meant for each chromosome. In our condition for un-dispensed cash reversal within few seconds the fitness function (ff) must be less than zero $(ff < 0)\ otherwise$ no debited fund reversal will successfully take place.

The decision variables' data set for the new system are represented as follows.

$$C_{a-n} = \{\, [t_0, L], [t_1, L], [t_2, L], \dots, [t_n, L]\}$$

Q is one data object, if R parts of data set named H in data set is far away from object. Therefore, $Q, S\epsilon T, R\epsilon T, then\ Q\ is\ Common\ Object.$ The defined data set, of the proposed data logging system will efficiently resolve issue of delay in reversing every unlawful debited funds using the generated population size for each chromosome. However, the transaction card (Tc), transaction day (Td), Transaction person (Tp), Transaction time (Tt), and Transaction platform (Tptf) attributes are depicted in Table 3.1. The transaction platform (TPtf) consists of the ATM-Machine, POS, and Internet Banking (IB). In this study our design specification is anchored on the transaction card attributes because none of the transaction platforms works without the ATM Card. Therefore, at this section of the study we define some set equations that simulates the ATM Card behavior of every transaction to validate or invalidate card user on the account of debited fund from the failed transactions.

Table 3.1. Data Set Cash Transaction Attributes

Item	Attribute
Transaction Card (TC)	ATM Card (MasterCard, Visa, Verve), Card Expiration, Bank, Security Code, Account Type.
Transaction Day (TD)	Monday, Tuesday… Sunday
Transaction Person (TP)	Name, Sex, Age, Work, Signature, State of Origin
Transaction Time (TT)	Morning, Noon, Evening, Night
Transaction Platform (TPtf)	ATM -Machine, POS, Internet Banking (IB)

The list of items attributes in Table 3.1 are used in the proposed system design for effective reversal of debited fund from cash transactions. The rules or strategy for reversing every debited fund of failed transactions are mathematically expressed thus:

$$IF\ C_a(L_t, n, t) = Dispensed *\ C_n$$
$$else$$
$$C_a(L_t, n, t) = Un - dispensed * \frac{Error}{C_n}(R_c)$$

Where R_c denotes cash reversal of debited fund. The condition for cash reversal when the ATM Card transaction is either successful or unsuccessful at a verifiable transaction location and time is stated thus:

$$ATM\ (C_a, t, n) = \ C_n \frac{(Dispensed * A)}{\sum_{i=1}^{n}(R^{t-1})}$$

$$T_{pu} \rightarrow ATMCard\ \frac{T_D}{PN} * \sum_{i=1}^{n}(R^{t-1}) - A_i$$

Where T_{pu} is the set of transaction person and ATMCard is the set of possible ATM Types (Visa, Master, and Verve), T_D is the set of transaction day (Monday, Tuesday,…Sunday), while PN is the transaction person's name, and A_i is the set possible set outcome of the transaction amount.

$$Reverse\ (R) \equiv\ C_{a1} * Ca_2 * \dots * C_{an} * L$$

Where L is the set of possible transaction location and a rule set K is specified by $K \rightarrow R.$ We aim to find the subset of K that applied to a single ATMCard or to group of them, hence minimizes the daily average exceeding transaction (ET) within the allowable time interval depicting several transactions that are unsuccessful to generate a defined data set.

$$A(C_a, t, n, L) = \sum_{j=1}^{n} \frac{R^{n-1}}{T_{pu}} * \alpha \rightarrow Data\ Set$$

The application of the genetic algorithm is to optimize the current system by getting rid of delay in reversing debited funds at failed cash transactions. In the new system, we ensured that set of inputs and outputs are considered for proper card analysis on every transaction. Figure 3.1 depicts input output process of the system.

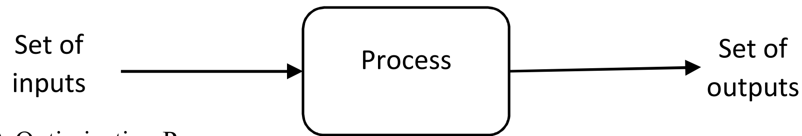

Figure 3.1. GA Optimization Process

The set of inputs from Figure 3.1 has two functions f1(x) and f2(x) similarly the set of outputs have two functions f1(y) and f2(y). This implies that input is represented by x while output is represented by y.
Mathematical to solve the problem of delay in refunding debited funds of failed transactions, we employed the equation below to handle stalagmite function of genetic algorithm.

$$f(x, y) = f(C_x, C_y) = f1, \quad xf2, \quad xf1, \quad yf2, \quad y$$

$$f1.x = [\sin(5.1\pi x + 0.5)]^6 \cos[(5.1\pi x + 0.5)]^6$$

$$f1.y = [\sin(5.1\pi y + 0.5)]^6 \cos[(5.1\pi y + 0.5)]^6$$

$$f2.x = \exp[-4|n(2)\frac{(x - 0.0667)^2}{0.64}]$$

$$f2.y = \exp[-4|n(2)\frac{(x - 0.0667)^2}{0.64}]$$

$Where\ C_x\ is\ the\ undispensed\ debited\ funds, C_y\ is\ the\ dispensed\ debited\ cash$

The new system delay resolution in seconds are stated thus:

$$while\ A_t = d(t, C_x, C_y) - qu(t - \tau, x),$$
$$with\ f(x) \leq a < 1\ and\ \tau > 0,$$
$$Here, the\ lower\ bound\ index\ in\ d_t$$
$$means\ the\ solution\ segment\ defined\ by$$
$$d_t\ (L, C_x, C_y) = dfast(t + L, C_x)$$

D Intelligent Data Logging System (IDLS) GA Modeling

In this section a model is designed to determine the bank customers whose transactions failed and were debited in error. Its function is to validate or invalidate the customer on the transactions activities that were unsuccessful with funds debited. Here, we describe a steady-state search algorithms that starts with a population η of size r. In most dispense dispute applications, this population would be chosen randomly from the search space, but there is no requirement for a random initial population. At each step of the algorithms, an element j is removed from the population, and an element i of Ω is added to the population, The selection of the element i is described by a heuristic function G. (For a genetic algorithm, G will describe crossover, mutation, and usually selection.) The selection of element j is described by another heuristic function D_r. (We include the population size r in this research as a subscript since there may be a dependence on population size.). In the steady state search algorithm, the heuristic functions G and D_r both depend on x, the current population. Thus, i is selected from the probability distribution $G(x)$, and j is selected from the probability distribution $D_r(x)$.

$Step\ 1$: $Choose\ an\ initial\ population\ \mu\ of\ size\ r$

$Step\ 2$: $X \leftarrow$

$uStep\ 3$: $Select\ i\ from\ \sigma\ using\ the\ probability\ distribution\ G(X)$

$Step\ 4$: $Select\ j\ using\ the\ probability\ distribution\ D_r(X)$

$Step\ 5$: $Replace\ X\ by\ X - \frac{e_i}{r} + \frac{e_.}{r}$

$Step\ 6$: $Go\ to\ step\ 3.$

Some heuristics that have been suggested for the D_r function include worst-element deletion, where a population element with the least fitness is chosen for deletion, reverse proportional selection, reverse ranking deletion, and random deletion, where the element to be deleted is chosen randomly from the population. In this thesis work the use of the term "steady-state genetic algorithm" for an algorithm that used random deletion. The random deletion is equivalent to reversing debited fund for unsuccessful cash transactions. Therefore, random deletion can be modeled by choosing $D_r(x) = x$.
The Condition for refunding failed Cash Transaction is mathematically formulated in the equation below.

$$C_{Ft}\ \sum_{Min=0}^{Max=n} \frac{(D_c - A_e)}{(D_{uc} - A_e)} * \frac{100}{1}$$

$Where, D_c = Dispensed\ Cash;\ A_e = Expected\ Amount\ to\ be\ withdrawn;$
$D_{uc} = un - dispensed\ cash\ Transaction$

$$if\ (C_{Ft} > 0)$$

This implies that the failed transaction is serious and critical. Here customers' identity must be validated before debited fund is reversed.

$$else\ (C_{Ft} < 0)$$

Here the case is minor and funds reversal is immediate and within few seconds without any delay.

E Difference of Mean and Probability Method

Applying the difference of mean and probability analysis, the condition for refund will be written thus:

$$Z_n = \frac{\mu_t - \mu_L * (\frac{n}{2})}{\sigma_A - \mu N^{t-1}}$$

$$\sigma_{t+L-n} = \sqrt{\frac{\sigma_S^2}{\mu_L}} + \frac{\sigma_F^2}{N^{t-n}}$$

$where\ Z_n = large\ sample > 30;$

$N^{t-n} =$

$number\ of\ customers\ at\ transaction\ time\ t\ and\ attempt\ n$

$\sigma_F^2 =$

$standard\ deviation\ of\ ATM\ failed\ transactions$

$\sigma_S^2 =$

$standard\ deviation\ of\ ATM\ successfull\ transactions$

Therefore, this research probability model for improving the delay process of cash transaction in reversing debited funds is stated thus:

$$P\left(R_s = {}^{1}/_{N}\right) = P(R_n > {}^{\varepsilon}/_{N})$$

$$= P\left(N_r\, \varepsilon + \gamma_n > {}^{\tau}/_{N}\right)$$

$$= P\ (R_s > -\delta_c {}^{\mu}/_{N})$$

$$= 2 - n + R_s F(-N_r \varepsilon)$$

$Where\ R_s =$

$refund\ of\ debited\ funds\ in\ seconds$

The Proposed System Flowchart

In this research study, we are solving the unsuccessful cash transaction debited fund problem by using only a genetic algorithm solution. The proposed system flowchart was realized with Genetic Algorithm principle of population definition, selection crossover and mutation and is shown in Figure 3.1.

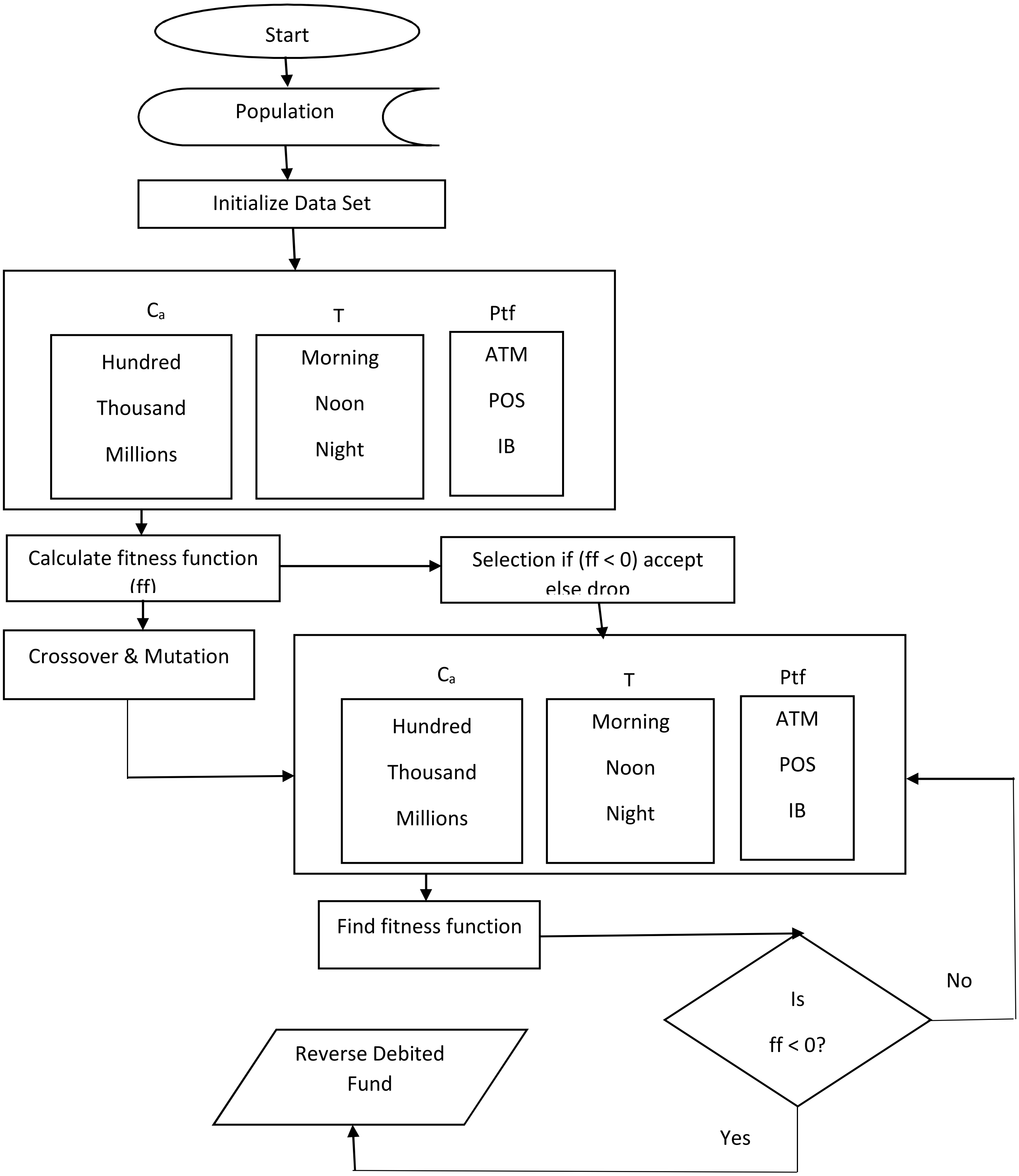

Figure 1.3. Genetic Algorithm System Flowchart

Figure 1.3 shown above, consists of pictorial detailed operation of intelligent data logging system with the highlight of some important features such as population, data set, fitness function, crossover, mutation and selection. The minimum and maximum amount of cash debited in a failed cash transaction is what made up the data set information together with the time and location of the transaction. The proposed IDLS system is aimed at getting rid of the cash reversal delay constantly observed in reversing debited funds of bank customers at their unsuccessful cash transactions.

RESULTS AND DISCUSSIONS

Genetic Algorithm Fitness Function (FF)

The data set of the system inputs and outputs defined in the system design are now tested with Matlab IDE to calculate the genetic algorithm fitness function values. Other results and findings were represented in 2D and 3D graphs illustrating how the issue of delay in refunding debited funds was handled by the new system. Figure 4.1 has the fitness function denoted by a letter x.

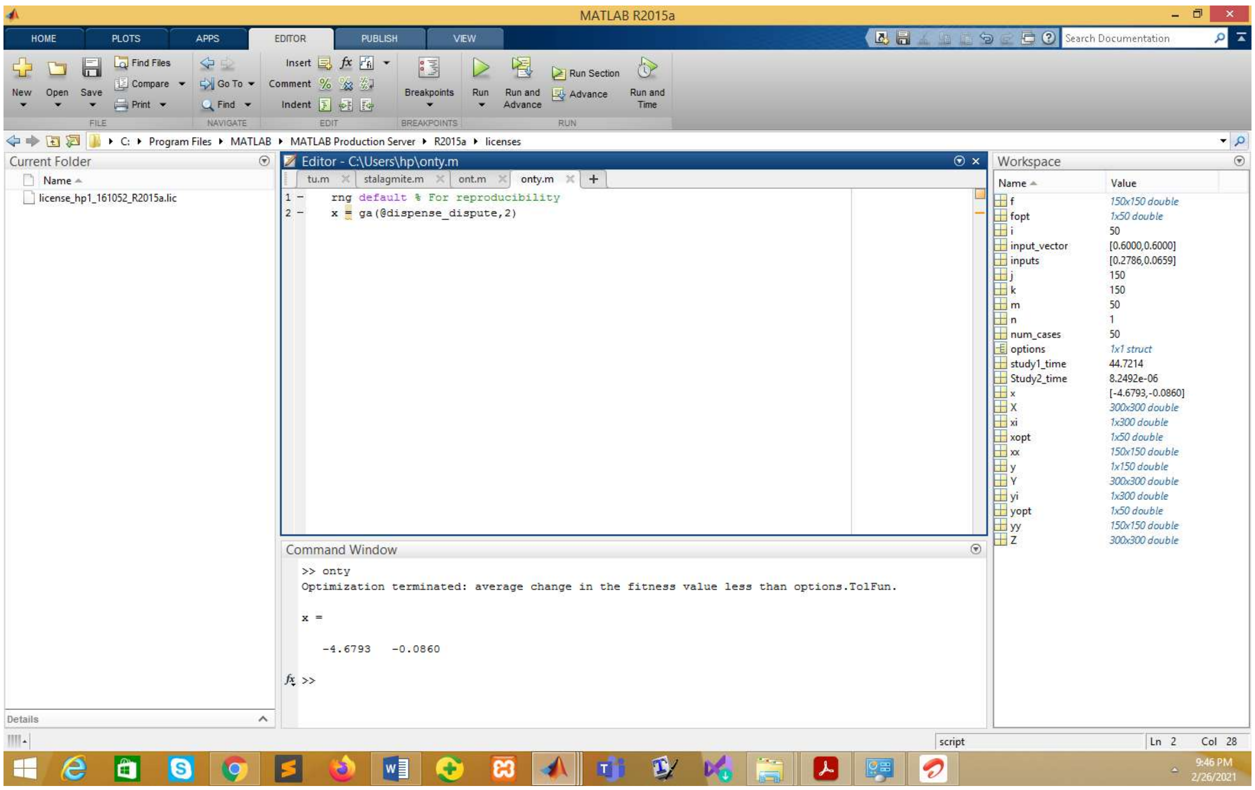

Figure 4.1. The Fitness Function System Optimization

The Figure 4.1, result of system optimization showed that fitness functions, values denoted by x are less than zero (0) and is a proof that failed transactions debited funds would be reversed immediately with negligible time lag or no delay unlike the current system that keeps the customers waiting for hours, days and weeks before un-dispensed debited funds are reversed. Figure 4.2 graphically detailed how the new system resolved dispense error with failed transactions. The y value denotes the successful transactions C_y while the x value denotes the unsuccessful transactions C_x. It was found that the coordinates of the function $(C_x, C_y) = (-5, -1)$. These values are less than zero (0) and said to achieve optimization since the $(-5, -1)$ coordinates is within the defined acceptable region of the genetic algorithm fitness function (ff). Also at this point the unsuccessful transactions debited funds are reversed within seconds unlike the current system.

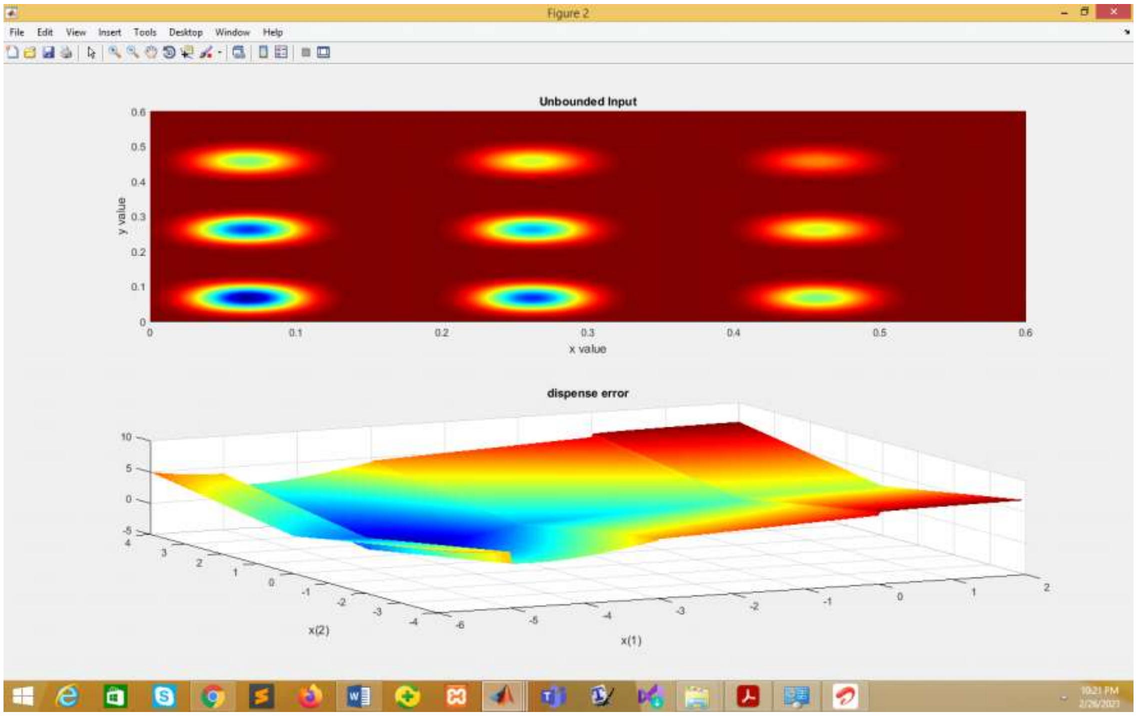

Figure 4.2. Successful and Unsuccessful Debited Transactions

Number of Transactions Attempts (Iteration)

The new system allows the user to make transactions with either debit or credit cards up to 50 times a day. Beyond the allowable iteration any debited fund will not be reversed.

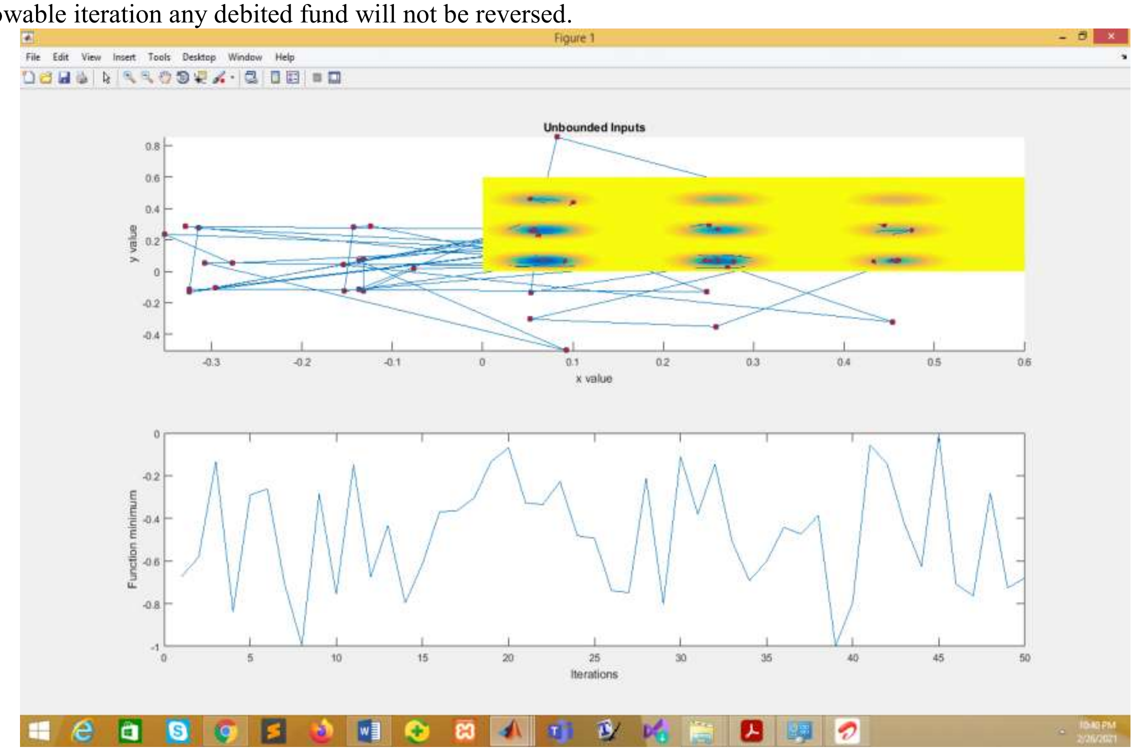

Figure 4.3. Daily Limit of Card Usage

It was found that the function minimum values for all the iterations allows for card usage are still less than zero (0) mining that the genetic algorithm fitness function was effectively optimized in the new system.

This showed that every card transaction attempt that yielded unsuccessful transactions with debited funds would be reversed within seconds without any stress on the card user.

CONCLUSION

The failed transaction with debited funds is indeed an ugly experience among ATM, and POS users. Most times people have to wait for 7 business working days before debited funds is reversed due to total dependence on the inter-switch management platform by banks. Therefore, in this research, we optimized the current system using genetic algorithm that got rid of the delay associated with the current system in reversing debited funds of failed transactions. The genetic algorithm's fitness function results of this study confirmed the efficiency of the new system in reversing un-dispensed debited funds within seconds and fast.

REFERENCES

Ahmadreza, G., Hassan, A., and Abdoreza, S. (2014). *Management Science Letter 3,* www.growinggscience.com/msl.

Fatai, A.S., Zakariya O.A., Samuel, O.O., and Mudashiru A.S. (2014). Effect of Automated teller Machine (ATM) on Demand for Money in Isolo Local Government of Lagos State, Nigeria. *Journal of Applied Business and Economic* Vol. 16(3), Pp. 171 -179.

Gupta, R.K., Bhunia, A.K., and Goyal S.K. (2009). An application of genetic algorithm in solving an inventory model with advance payment and interval valued inventory costs. *Mathematical and Computer Modelling section of Elsevier,* www.elsevier.com/locate/mcm

Mohammed, M., Mohammed, A.A., and Alexander S. O. (2014). The effects of customers experience on ATM refund system failed bank transactions: A case study of deposit money banks in Maiduguri, Borno State, Nigeria. *Journal of Business and Management (IOSR-JBM),* 16(11), Pp. 50.67.

Ramakalyani, K. and UmaDevi D. (2012). Fraud Detection of Credit Card Payment System by Genetic Algorithm. *International Journal of Scientific &Engineering Research,* 3(7), Pp. 1-6.

Sujata R., and Hrushikesh M. (2018). ATM Availability Management System, published on *IOSR Journal of Computer Engineering*, Pp 21-31
.

Vladimir, M., and Irina P. (2013). Numerical Integration by Genetic Algorithm. *International Journal "Information Theories and Applications"*, 20(3), Pp. 252-262.