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TOWARDS THE MANAGEMENT OF B2C AND B2B E-COMMERCE TRANSACTION FAILURES THROUGH BOT-MEDIATED COMPONENT

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Abstract

Intermittent connectivity failure and the stateless nature of the web are some of the major primary reasons for failures of business-to-consumer (B2C) and Consumer to Consumer (C2C) e-commerce transactions. Following such failures, an e-commerce transaction which may have involved parties across different geographical divides and jurisdiction often becomes a source of headache and customer-vendor dispute especially when the incidence and claims thereafter are not resolved on time. In some scenarios, incidence resolution may become more difficult where the e-commerce merchant lacks control over any transaction that occurred outside its own platform. The customer is often the victim of any loss following such failed transactions. This paper proposed a bot-moderated incidence resolution system that would ensure e-commerce transaction failures are remedied on time during and after the transactions. The bot-mediated system works by automatically instantiating a bot at either end of the sender (transaction site) and receiver(payment processor/payment gateway)at the commencement of any transaction processing chain (TPC). Following a handshake between Bots, the sender bot transmits relevant transaction details to the receiver bot including the sender bot's identity. Relevant entries are made in either system databases to reflect the statuses of the communication. In case of any inconclusive transaction or failed transaction, the customer can establish communication with the merchant Bot (MBot) on a merchant platform. The MBot has capacity to send/receive messages to/from a remote Bot (either at the Payment Gateway or Payment Processor) regarding any customer transaction at the background. In this way, incidences of electronic transaction failures are technically resolved timeously.

Keywords: Bot, Bot-mediated e-commerce, incidence resolution, remediation of electronic transactions

1. INTRODUCTION

E-commerce is one of the most remarkable digital breakthroughs in the last decade. As the global Internet user penetration [1, 2] continues to soar, there has been a marked corresponding increase in the E-commerce businesses. It is recorded that Retail ecommerce sales around the world reached $2.304 trillion in 2017[3]and $2.86 trillion in 2018[4, 5, 6, 7, 8] with an estimated online retail buyers hitting 1.8 billion. That shows the potential of e-commerce and the rate at which it is gaining acceptance as the most prospective business models ever. With sophisticated e-commerce applications [9] on the rise on a daily basis, the global market barriers are consistently eliminated to pave way for a more inclusive fair bargain regardless of race, region, or socio-political endowments [10]. Due to its virtual nature involving parties from different jurisdictions whose laws differ greatly, disputes arising from transactions especially failed ones have remained a point of concern and deliberation at the national and international levels. However, this outstanding technology of the 21st century is bedeviled by a lot of challenges. Three common challenges faced by E-commerce implementation teams and users are:

a. Cybersecurity issues [11,12,13,14].
b. Legal issues including dispute resolution arising from breaches on e-commerce transactions, and jurisdiction [15,16,17].
c. Technological issues that tend to affect and question the availability[18] and integrity of e-commerce transactions

Though the foregoing issues are grouped under three separate headings it must be borne in mind that there is a sterling

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relationship among them, for instance, most legal issues bordering on cyberspace and Information Technology legislation are part of cybersecurity measures that are designed to ensure safety and security on the cyberspace. In the same vein, many technology issues are created by cybersecurity flaws, for instance, a denial of service (DOS) attack is a potential cybersecurity issue which may potentially undermine the availability and integrity of resources over a public network.
Notwithstanding the foregoing this paper is intended to dwell only on the technological issues especially those that concern availability of resources that drive the completion of transactions by customers and users of e-commerce systems where transactions that cut across geographical barriers are conducted.

1.1 Aim and Objectives of this paper

This paper is aimed at briefly reviewing the various platforms and architectures that drive e-commerce transactions and the ways of guaranteeing the success of e-commerce transactions as an aid to the design of a reliable system using software elements called bots. The specific objectives are:

i. To appraise the existing systems of enabling and reducing failures in the e-commerce transaction processing cycle.
ii. To re-examine the nature and capabilities of software elements (bots) in transaction processing environments
iii. To review modus operandi of bots in a connected environments such as the Internet
iv. To evolve an architecture of a bot-mediated transaction processing architecture especially for e-commerce transaction processing and demonstrate how such architecture can forestall transaction payment processing failures and ensure customer feedbacks on transaction processing chains.

1.2 Research Questions

To realize the stated objectives in this paper the following questions have been formulated. They are:

i. What are the potential causes of transaction failures in an e-commerce transaction processing platforms?
ii. To what extent have the problems been tackled by the existing e-commerce systems?
iii. Having regard to the existing architectures in (iii) above, is the evolution of a new architecture justified?
iv. How would the proposed architecture operate and how can it be implemented?

1.3 E-commerce transactions and Payment Processing

E-commerce has become an area of interest for nearly over two and a half decade. Simply put, e-commerce is any trade related transaction involving two or more parties over an electronic network usually an Internet. In this section the vital elements and characteristics are briefly discussed.

1.3.1 E-commerce transaction models

Various e-commerce business models have been implemented and documented in the last two decades [14]. They are:

i. Business to Business (B2B): Wherein two business organizations none of which is a final consumer is involved in the exchange of goods or services over a network especially the Internet.
ii. Business to Consumer (B2C): The flow of exchange is from the Business organization (vendor) to the consumer[19]
iii. Business to Government (B2G): An online platform (usually owned by a business organization) for conducting transactions involving Government agencies. A typical example the use of commercial bank internet banking platforms to pay charges, taxes, fines, etc. to Government agencies.
iv. Consumer to Consumer (C2C): One of the commonest model where the parties involved in the online transactions are final consumers. In this model, the e-commerce platform is neither owned by any of the consumers but provided by a third neutral party to enable consumers buy and sell. Typical examples are www.jiji.ng and www.checki.com.ng both of which are Nigerian C2C e-commerce sites.
v. Government to Business (G2B): In this model, the Government agency calls the shots i.e. it uses the platform to transact with business organizations. Typical scenarios are seen in such online platforms used by government ministries/agencies to conduct auctions, request for proposals, request for tender, request for bid, and bid submissions. A typical example is the Nigeria Single Window for Trade Platform operated by the Nigeria Customs Service and used by banks and other businesses to process import transactions form themselves and on behalf of their customers.
vi. Government to Citizen (G2C): this is not so common. A common scenario is a Government Auction such as that operated by the Nigeria Customs Service for auctioning seized and/or contraband imports.

1.3.2 Stakeholders in the E-commerce Transaction Processing chain

Figure 1 shows the various stakeholders in a typical e-commerce transaction. The various stakeholders are:

i. Financial institutions (Commercial Banks): these are central to the collection of funds arising from e-commerce transactions. In arrangements involving payment card networks banks are often the Card issuers, that is, they provide the physical cards to customers (consumers) and also determine the fees or finance charges to be levied on users of the cards. Note that there is no rule that prevents a bank from providing the services of a payment network. However, it is common to see banks as just card issuers. The foregoing is the applicable situation in Nigeria where

according to the Central Bank of Nigeria(CBN), "Only banks licensed by the CBN with clearing capacity shall issue payment cards to consumers and corporations whereas Banks without clearing capacity can issue in conjunction with those with clearing capacity"[20] As card issuers, banks can do the following: Approve or deny debit/credit card applications by customers; Set the terms of the card usage; settle transactions on behalf of the cardholder; Collect payments from the cardholder; and Provide customer service[12]. The financial institution may also act as an acquirer to collect funds on behalf of a merchant.

ii. Payment Networks: Payment networks coordinate the behavior of banks, merchants, and consumers by setting certain prices and rules [21, 22]. They include: Payment card networks (MasterCard, Visa, Discover, American Express, etc.) and Electronic Fund Transfer Networks (Western Union, Nigeria Inter-Bank Settlement System (NIBSS), etc.)

iii. Payment Processor (PP): A mediator between the consumer and the financial institution/acquirer in payment transaction. The payment processor is responsible for authorizing the transaction as well as ensuring that the merchant/retailer (seller) is paid on time by facilitating fund transfer from customer's account to that of the merchant's acquirer. Most payment processors are financial platforms that usually work in the background to process payments for merchants (online sellers). They work in consonance with payment gateways. Note that a PP may be owned by a financial institution. Examples of PPs in Nigeria are: GTPay(owned by Guaranty Trust Bank), WebPay(owned by InterSwitch), E-Tranzact, SimplePay, Global Pay(owned by Zenith Bank Plc), Collect(owned by United bank for Africa Plc.)

iv. Payment Gateway (PG):this is a medium/channel between the merchant's e-commerce site and the payment processor. The PG is a necessary requirement in most e-commerce transactions involving international parties especially where the merchant's portal cannot directly communicate directly with the payment processor. The PG may have both the Consumer and Merchant's electronic accounts. For example, a consumer who has a PayPal account may use it to pay an online seller who also maintains a PayPal account. Examples of PGs are PayPal, SecurePay, Adyen,Voguepay, PayStack Amplify, etc. It is not inconsistent to see a PG that is also a PP.

v. Digital wallet providers: A digital wallet is an online service that enables an individual to make electronic transactions [23]. A digital wallet often links an individual's bank account andmay require the submission and verification of the individual's identification documents such as international passport, driver's license, national ID cards,etc. The subscriber of the wallet may send his credentials to a merchant's terminal wirelessly through near field communication (NFC). Examples of digital wallet providers are: Skrill, PayPal, Google pay, Microsoft Pay, Apple Pay, Apple wallet, Lemon wallet, etc.

vi. Retailers/Merchants: these are the online sellers whose goods or services are presented to be sold through the e-commerce platform.

vii. Consumers: these are online buyers.

1.3.3 Causes of Transaction failures and Mechanisms for remedying them

Causes of Transaction Failures

The common causes are: Customer's insufficient funds; incorrect customer's electronic [card] payment/account details; Expired debit/credit card or Closed/Dormant Bank account; Authorization failure or denial by customer's Bank; Reversal of debit transaction by Bank in favour of the Customer, System errors including application failure; Intermittent Connectivity failure on the side of the Customer; Cyber-attacks on the E-commerce platform, etc. Intermittent connectivity failure on the side of the customer and cyber-attacks especially man-in-the middle and denial of service attacks are very likely to bar the customer from knowing the state of his transactions.

Remedies to Transaction failures

To avoid losses that may ensue due to transaction failures, the commonly used documented remedies are:

i. Use of dedicated customer service;
ii. Online incident management teams;
iii. Cybersecurity measures
iv. System feedback and notification

While the remedies are consistent with the ideals of maintaining a virtual business platform; there are often gaps in the measures. For instance, collecting data on failed transactions may need much follow-ups, re-billings, etc. involving human agents that may ultimately result to high wage bills and inefficiency as workload on the human agents/personnel increases. More often than not, customers do not receive notifications as to their failed transactions especially when the vendor/merchant does not have control over the PG or PP. There are often scenarios where the customer's account is debited even though the status of the transaction is unknown to the customer.

1.3.4 Tracking E-commerce transaction failures

E-commerce like other important network-driven transactions are virtual and conducted on the cyberspace with some level of attendant risks that could mar negatively affect each stakeholder in the process chain. It is believed that either the online buyer or seller or owner of the platform may be a victim though the direct victim are more often the buyers who stand a higher chance of losing money or effort due to failed transactions. The following mechanisms have been used for tracking E-commerce transaction flows:

i. Use of automated analytics (often a third-party solution e.g. Google analytics, etc.)
ii. Use of mechanisms built into the merchant's e-commerce portal
iii. PG/PP's transaction tracking component
iv. Application Programing Interface feedback mechanisms
v. Semi-automatic tracking method which tracks transaction failure on a case by case basis

1.3.5 Bots

Bot is a condensed name for a Software robot [24]. A Bot is a computer program that acts as a virtual assistant in such a way as to simulate or mimic a human actor in the same circumstances. Bots may be intelligent or unintelligent. Attempts have been made at classifying bots [25, 26, 27, 28, 29]. An important category of Bots which is the subject of this paper is the Proactive Bots. Proactive Bots are endowed with the ability to provide the right information at the right time and place hence are considered suitable for deployment as active mediating components in an e-commerce transaction failure scenario especially a scenario where communications can be established between the various transaction processing components in an E-Commerce transaction chain.

1. MATERIALS AND METHODS

2.1 Materials

The materials employed are divided into two:
Software and Hardware.
The Software are:

i. Microsoft Windows 8.1 Operating System with Microsoft Visual Studio 2015 and Microsoft IIS 7.0 or higher installed
ii. Simulink software
iii. Microsoft Bot Framework; Microsoft SignalR
iv. Ngrok(Network tunneling software)

The Hardware used is a 3.5GHZ PC with 16GB RAM, 500GB Hard Disk storage

1.2 Method

The methods employed in the design and implementation of a bot-mediated E-Commerce platform are:

i. Review of transaction flow on common e-commerce transactions of a Business to Consumer (B2C) and Business to Business (B2B) e-commerce platforms
ii. Analysis of transaction failure determinants using simple logic and mathematical tools. This is conducted by evaluating the speed and latency of the customer's connection vis-à-vis the e-commerce server availability and reliability. The bot uses the result of this analysis as a basis for advising on the strength of the customer's connection and the possibility of having a failed transaction owing to the poor connection or due to potential problems arising from the e-commerce server.
iii. Object-based modeling [30, 31, 32].
iv. Agent-based modeling and Simulation[33]
v. Programming and Testing

2. RESULT AND DISCUSSION

3.1 Results of analysis on e-commerce transaction failure determinants

Transaction failure determinants were categorized into two:

(i) Connectivity-oriented determinants
(ii) Incorrect user information

The connectivity-oriented category is of major importance and is further divided into client-based, and e-commerce server-based. The client-based determinant revolves around bandwidth and latency of the customer's internet connectivity whereas the e-commerce server stability is considered in terms of availability and reliability. The technical parameters that could be used to determine a successful and sustained connectivity during a given e-commerce transaction is given by the four inputs:

(i) Latency of connection
(ii) Bandwidth of connection

(iii) E-commerce server availability
(iv) Reliability of server
The connectivity function is expressed as:

$C=f(L, B, A, R)$ (1)
Where C=connectivity co-efficient for maintaining a successful e-commerce transaction, L=network latency on the side of the customer, B=Bandwidth of Customer's link, A=Availability of the E-commerce server, and R=Reliability of the E-commerce server
Availability is measured by the average uptime (in hours) of the server in a week. An uptime of 80% and above is rated 1 whereas the reverse is 0. That is:
Availability $(A) = (\Sigma n/h)*100$ (2)
Where n=number of hours of server availability in a week; h=number of hours in a week
Reliability is measured as the average percentage of successful transaction response cycles in a week. That is:
Reliability $(R)=(\Sigma s/n)*100$ (3)
Table 1 shows the truth table for the four input parameters. The output from the truth table which is the basis for Bot's prediction on customer's connectivity, C is given by:
$C = \bar{L}BA\bar{R} + \bar{L}BAR + LBA\bar{R} + LBAR$ (4)
Where L=latency, B=bandwidth, A=availability, and R=reliability

Table I: Truth table for input parameters

LATENCY	BANDWIDTH	AVAILABIILITY	RELIABILITY	CONNECTIVITY
L	S	A	R	C
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Minimizing the connectivity output, C using Karnaugh Map, we have the result presented in Table II.

Table II: Karnaugh map result

$LBAR$	$\bar{A}\bar{R}$ **00**	$\bar{A}R$ **01**	AR **11**	$A\bar{R}$ **10**
$\bar{L}\bar{B}$ **00**	0	0	0	0
$\bar{L}B$ **01**	0	0	1	1
LB **11**	0	0	1	1
$L\bar{B}$ **10**	0	0	0	0

The simple logic for C is thus:

$C = BA$ (5)

The connectivity output, C can be implemented using a 2 input AND gate as shown in figure 1.

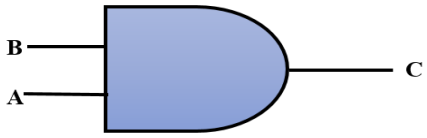

Figure 1: Bot's prediction logic on customer-connectivity for sustaining an e-commerce transaction

3.2 E-commerce transaction cycle

As Bots are software components akin to agents, it is necessary to understand the underlying communication flows between the real-life components in an E-Commerce transaction processing platform. Figure 2 shows a typical transaction flow diagram in a B2C E-commerce platform. The dotted lines shows the logical flow of events. Notice the feedbacks or responses at the various processing points. There may not be a feedback at the point of failure or perhaps not communicated to the appropriate party.

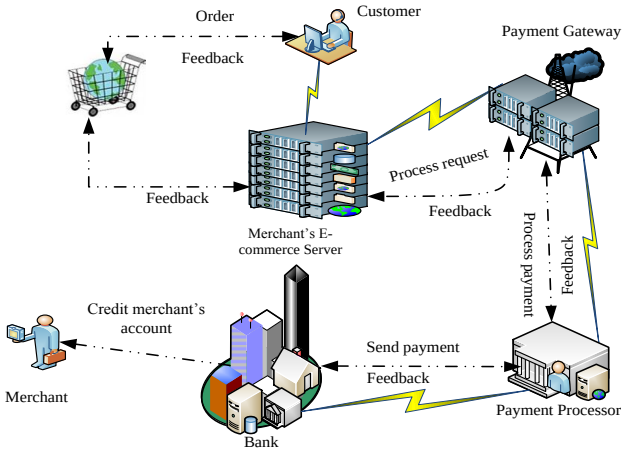

Figure 2: E-Commerce Transaction cycle

3.3 Designing a Bot-driven Model

The steps in building the bot-driven model involved the identification and specification of:

i. The Bot characteristics, functions alongside the Objects it may interact with in any given event were identified including the network characteristics as presented in section 3.1 above.
ii. The environment, extents and intents of the Bots
iii. Methods through which attributes of every Bot is maintained/modified in response to either a Bot-to-Bot communication in the Transaction Processing cycle.
iv. The Protocol of communication including API requirements including network tunneling.
v. The Interactions between the sending Bot and the receiving Bot including activation time, information to be exchanged, state maintenance, and deactivation.

Figure 3 shows the Bot characteristics, functions/intents, and communication channels as well as the objects manipulated by the Bots. Three Bots each of which is to reside at the electronic platforms of the Merchant (***MBot***), Payment Gateway (***PGBot***), and Payment Processor (***PPBot***) respectively. A channel of communication exists and may be established through an API provided by either of the Payment Gateway or the Payment Processorto the Merchant. In any situation where the Payment Gateway is same as the Payment Processor then a single API would suffice. The MBot is activated in either of the three ways: customer placing an order, payment for an order, or complaint following the payment of an order.

Figure 3: Bot specifications, intents, communications, and associated objects

3. CONCLUSION

This short communication reflects a work-in-progress. It was conceived to address the problems facing consumers and businesses on E-commerce platforms especially as it affects incidence resolution. The use of Bots have been proposed owing to the fact that can mimic human intelligence in various ways. In this paper, we have identified the requirements for building a bot-mediated incidence resolution system whereby the various processing components of an e-commerce processing chain can interact with each other by way of communication via artificially intelligent bots. We are working on realizing the prototype which we believe will save businesses enormous cost and effort expended on the use of dedicated human agents in the process of resolving transaction failures on e-commerce platforms.

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