International Digital Organization for Scientific Research ISSN: 2550-794X
IDOSR JOURNAL OF SCIENTIFIC RESEARCH 6(2) 20-29, 2021.

Design and implementation of tax payment system using fingerprint biometrics and bank verification number

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ABSTRACT

This research work, Design and Implementation of Tax Payment System using Fingerprint Biometrics and Bank Verification Number, focuses basically to simplify tax administration,mitigate tax evasion and improve voluntary compliance.The study aimed to develop a systemthat can capture employer, employee, businessmen and artisans' fingerprint and bank verification number, use them to verify and monitor their tax activities at will.The difficulties faced by tax authorities in getting individual taxpayers to pay their tax by sharing demand notice and sealing up business outlet etc., failure and delay in paying employee returns by many private enterprises, leakages and diversions of generated funds as seenamong corrupt tax and bank officials, forgery of tax certificate and total tax evasionin our society today has motivated this work. The methodology adopted is object-oriented hypermedia design methodology (OOHDM).OOHDM is one of the first methods to postulate the separation of concerns that defines its various models: requirements, conceptual, navigation, abstract interface and implementation. JavaScript, PHP, HTML and MySQL were used to build the tax payment system.The system provides interfaces, through which tax authority can register, update and verify the tax payment compliance status of employee of companies and individual taxpayers. The results obtained using thissystem includes, providing a platform for tax authority and other government agencies to verify taxable individuals, taxpayers can pay and view their tax history at the comfort of their homes, also, the bank plug-in can monitor and send persuasive text message to any tax invader or defaulter during bank transaction.

Keywords: Tax payment, fingerprint, biometrics and bank verification number

INTRODUCTION

Tax is any form of charge levied on a person or an institution by a governing body or its equivalent such that defaulted payment is punishable by law. The imposition of taxes and the institution of taxing are as old as civilization itself cutting across religion, race and continental borders. Prompt tax payment and reduced tax evasion is always a primary objective of the government in most civilizations that exist today [1]. The issue of tax evasion has proven to be a difficult practice to curb even in nations with a proper database of its citizenry and the current mode of tax payment is redundant and hectic [2]. In addition, [3] suggested that understanding how citizens perceive and experience taxation may provide an essential diagnostic of the political realities for tax reform. Consequently, Taxpayers' behavior towards tax system has evoked great attention among many Revenue Authorities in the world especially in developed countries. However, it is debatable on what has been done towards the study of taxpayers' view towards tax system in developing countries [4]. [5], also explained that taxpayer non-compliance is a continual and growing global problem that is not readily addressed. Following the increasing cases of tax noncompliance, especially tax evasion and its consequences on the capacity of government to raise public revenue, great amount of attentions has been paid to the issue of tax compliance globally by public policy makers and researchers for the past few decades [6,7,8]. However, there are massive research evidences on tax compliance behavior linked to developed countries, which limited the issues of noncompliance on developing countries [9,10]. Perhaps, understanding the taxpayers' behavior and perception in terms of their satisfaction towards tax system and how it influences the tax compliance, there will be a solution to this gap [11]. In line with the above discussion, there has been a growing concern in literature on the contribution of tax compliance to the design and

improvement of tax system [12]. The emergence of new technologies for tax implementation and processing has received global appraisals and acceptability, and seems to be the panacea.

Aim and Objectives of the Study

The aim of this work is to design and implement a web based electronic tax payment and verification system that will combine bank verification number (BVN) with finger print biometric system for more secure and error-free authentication.The system is designed with the following objectives:

a) To explore the problems associated with the existing password/username based systems and propose possible solutions.
b) To integrate a system that captures the finger metrics of all taxable adults, match them with BVN, and make them accessible with capabilities of interfacing with a third party such as banks.
c) To develop an e-tax payment and verification system with secure authentication using combination of biometric technology and Bank Verification Number (BVN)
d) To implement the system with sample customer biometric and BVN data and test its functionality and robustness.

METHODOLOGY AND SYSTEM ANALYSIS

Methodology Adopted

The proposed methodology to be adopted is the object oriented hypermedia and design methodology (OOHDM). In OOHDM, a hypermedia application is built in a four-step process, supporting an incremental or prototype process model. Each step focuses on a particular design concern, and an Object-Oriented model is built. Classification, aggregation and generation/specification are used throughout the process to enhance abstraction power and reuse opportunities. These phases are summarized below.

System Analysis

Analysis of the Existing System

The present tax payment system is structured in such a way that a tax liable adult should first of all obtain tax identification number (TIN), and fill self-assessment form. Assessment will be carried out and the liability determined. Then, the individual goes to the bank for the payment, and after which, he returns with the teller to the tax office for the purpose of issuing a tax general receipt or tax clearance certificate. In the case of salary earners, the tax is deducted from the source before salary is paid to staff. Staff of the tax authority will use the employee's or clients' annual income to carry out tax assessment in order to determine the tax due to the person. This assessment is normally done using either a calculator to compute the tax or using computersoftware such as electronic spread sheet like Microsoft excel. The tax assessment exercise takes a lot of time as the tax assessment staff has to go through the income details as submitted by the company or the tax payer in order to calculate the required tax-free allowances, taxable income and the tax due. The general tax receipt GTR is only issued to them on demand, while further assessment is carried out before the tax clearance certificate TCC will be issued to ascertain and include other means of income. In the existing system, tax payment verifications are done through direct contact with the tax payer.Based on the assets declared, an individual with no payment records will be required to pay for three previous years. This verification exercise is only active for people seeking for government approvals, contracts or political positions. This means that if you are not doing any business with the government, your tax payment may not be verified hence the tax payer continues to evade tax as long as he/she wishes to the detriment of government developmental goals. The Nigerian tax system has undergone several reforms geared at enhancing tax collection and administration with minimal enforcement cost. The recent reforms include the introduction of TIN, (unique Taxpayer's Identification Number which became effective since February 2008), automated tax system that facilities tracking of tax positions and issues by individual taxpayers, e-payment system which enhances smooth payment procedure and reduces the incidence of tax touts,

enforcement scheme (Special Purpose Tax officers), these are special tax officers in collaboration with other security agencies to ensure strict compliance in payment of taxes. The tax authority now has autonomy to assess, collect and record tax. This enabling environment which came into being on the basis of (Section 8(q) of FIRS Establishment Act 2007) has led to an improvement in tax administration in the country. The Federal Inland Revenue Service (FIRS) has announced the introduction of six (6) new electronic tax services (e-services) [13]. The initiatives underscore the efforts of FIRS towards ensuring that key tax processes are automated in order to improve transparency, ease and speed of tax administration; for both taxpayers and tax administrators. It is also in alignment with the goals of the Presidential Enabling Business Environment Council (PEBEC), which was setup February, 2017. However, FIRS is making more efforts at going fully automated and becoming paperless in the near future, whereas, their state and local government counterpart hardly fosters a functioning websites. It is very imperative to state, as a matter of clarity, that the process of tax payment, assessment and clearance, despite efforts to automate, remain largely, a manual operation [14].

Personal Income Tax Rate Structure (Old and the New)

Based on the amendment dated 14 June 2011, President Goodluck Jonathan on Tuesday 13 December 2011 announced signing into law the new Personal Income Tax (Amendment) Bill. The new Personal Income Tax (Amendment) Bill has this key change on the introduction of a consolidated tax free allowance of N200, 000 or 1% of gross income, whichever is higher, plus 20% of the gross income. Gross emolument (or income) is defined to include benefits in kind, gratuities, superannuation and any other incomes derived solely by reason of employment [15]. The tax rate newstructure use in assessing the tax rate payable by the tax payers comparing to the old rateis shown in table 1.

Table 1 Personal income tax rate structure

.Old Bands	Old Rates	New Bands	New Rates
First N30,000	5%	First N300,000	7%
Next N30,000	10%	Next N300,000	11%
Next N50,000	15%	Next N500,000	15%
Next N50,000	20%	Next N500,000	19%
Above N160,000	25%	Next N1,600,000	21%
		Above N3,200,000	24%

The analysis of the annual gross income bands and the implications for different categories of income earners is shown in Table 2.

Table 2 Personal income tax rate structure

Gross annual income	**Tax implication**	**Comments**
N345,000	Higher taxes	These category of individuals will suffer 100% increase in tax as a result of the increase in minimum tax from 0.5% to 1% of gross emolument
N441,500	Indifferent	Tax payable is the same under the new amendment but any individual earning less than this would see their taxes increase by up to 100% in some cases (see above)
N441,500 - N12,150,000	Lower taxes	Individuals in this gross income bracket will see a reduction in their tax liability of up to 4.8%
Above N12,150,000	Higher taxes	Any individual earning more than N12.15m per annum will pay higher taxes by up to 1.5% in view of the higher effective tax rate under the new amendments notwithstanding the marginal reduction in the top tax rate from 25% to 24%.

Assumptions:

The above analysis is based on the following assumptions:

- No other allowances are granted under the amended PITA other than the consolidated allowance and personal relief.
- Individuals comply with all statutory deductions and contributions including NHF and pension.
- The compensation under the old PITA was structured for tax efficiency (the result will be different if otherwise). If the compensation under the old PITA was not structured for tax efficiency then the amended PITA will result in a decrease in tax liability for all individuals regardless of income bracket.

Input Form Specification of the Present System

Sample of self-assessment forms to be filled by the tax payers are displayed in the figure below:

GOVERNMENT OF ANAMBRA STATE OF NIGERIA
STATE BOARD OF INTERNAL REVENUE SERVICES
FORM FOR RETURN OF INCOME, CLAIMS FOR
RELIEF AND FOR SELF ASSESSMENT
TO……
…… ISSUING OFFICE…….
…… FILE NO……

INCOME TAX YEAR 20…….

PART ONE

PERSONAL DATA OF THE TAXPAYER

NAME IN FULL (SURNAME FIRST)……...
NATIONALITY……...
MARITAL STATUS……
ADDRESS OF BUSINESS/EMPLOYMENT…….
OCCUPATION……
NAME AND ADDRESS OF EMPLOYER (IF ANY)…….....
RESIDENTIAL ADDRESS AT 1ST JANUARY (20….)……
ADDRESS OF BUSINESS/EMPLOYMENT OF YOUR SPOUSE……...

PART TWO

SOURCES OF INCOME

a)Income from trade, business, profession/vocation
b) Employment income form:-
(i) Salary…….
(ii) Allowance, Commissions, Bonuses etc…….
(iii) Monetized Benefit (B.K)……...
c) Dividends received……...
d) Rental incomes……
e) Other income (specify)…….
f) Aggregate income from all sources (a-e) N……..

PART THREE

CLAIMS FOR ALLOWANCES AND RELIEFS (FPA)

(a) Personal Allowances……
(b) Children Allowance…….
(c) Dependent Relative Allowance……

Figure 1:Input specification of tax assessment form of the existing system

Below is the display of the output specification of the existing system that is issued to a tax payer after payment is made:output specification of the existing system

DECLARATION WHICH MUST BE COMPLETED AND SIGNED BY THE TAXPAYER:

I…….hereby declare that the information given by me in this form contains the true, correct and complete statement of my income, from each and every source and that the claim for relief and tax computed accord with the provisions of the PITA Cap P8 LFN as amended. I further declare that any incorrect information given by me in this form whenever discovered shall count against me in any action for recovery or enforcement of tax.
GIVEN UNDER my hand this……day of …….2……...
……..
(Signature of person making this Return)

FOR OFFICE USE
FORM Received by……..
Date Received……...
Information: (a) Accepted……..
(b) Rejected……...
(c) Amended/Recomputed……
Taxpayer communicated:……
By:……

Figure 2: output specification of the existing system

Data Flow Diagram of the Existing System

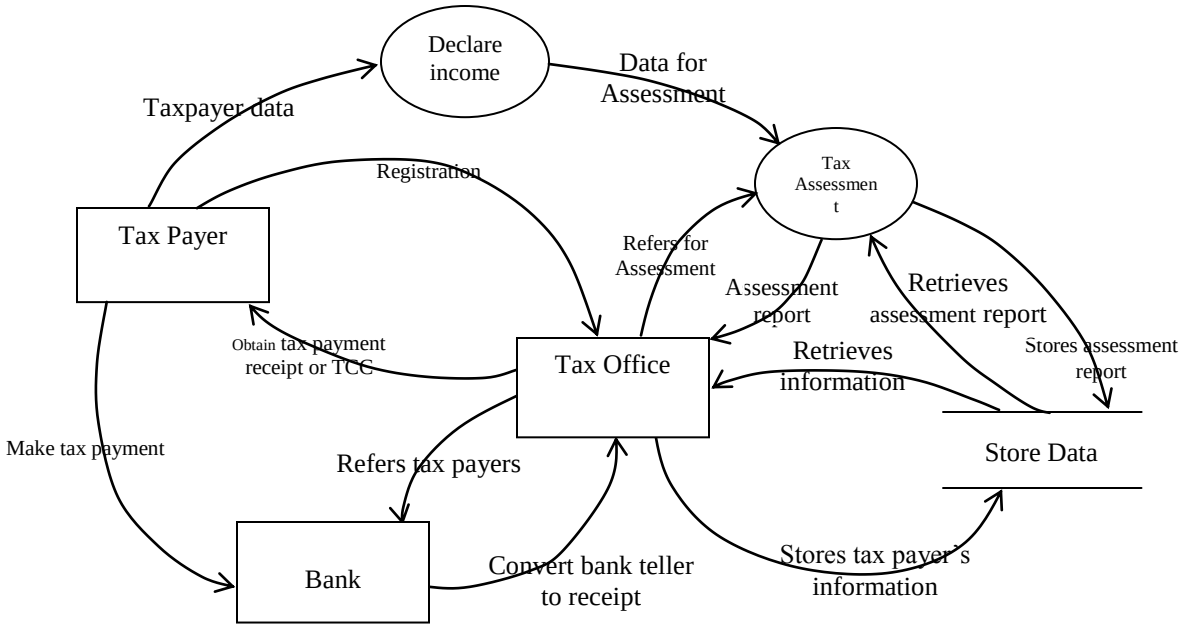

Figure 3: Data Flow Diagram of the existing system

Figure 3 above shows the logical data flow of events in the existing system. It shows the connections between the employee, businessmen, the tax administrators and tax payments in the bank. There exists links to third party databases and transactions. Examples are employee database and tax transactions.

Advantages of the Present System

Even though there is a proposed modification of the existing system, it still possesses some desirable advantages. Here are few advantages of the existing tax system:

i. The existing system covers other forms of revenue generation activities of the board of internal revenue, for example, Developmental levies, Naming of street registration fee in state capitals, Right of occupancy fees in state capitals, etc.
ii. The system is less capital intensive

Disadvantages of the Present System

The existing system is a partially automated, and it has some disadvantages which include:

1. The assessment of tax payers is done manually every year. This introduces a lot of malpractices in the system as most tax payers can bribe the tax assessment officer to influence his/her liable tax by lowering the income rate and thereby reduce the tax payable. This leads to loss of income of the government
2. To obtain Tax Clearance Certification, tax payer will have to visit tax office for assessment. It often takes weeks and even months to complete the assessment of individuals and companies tax for the year, thereby introducing delay in the process.
3. Verification of tax payment is only done when a tax payer need approvals or contracts from the government. This calls for collection of his/her previous tax receipt for the period of three years. Most often the receipt is lost and the tax payer will be compelled to pay again as there is no online accessible database for the tax payer to view his/her tax reports.

4. Due to lack of constant verification of tax payment, tax payers like businessmen do not even know that paying tax is their civic duty. They see it as what is meant for government workers alone.
5. In the market, tax collection is sometimesassigned to the market union delegates. They collect the tax as levy, which they may not remit accurately to the government purse and there is no proper medium to verify the actual amount paid and from whom.

Analysis of the New System

To improve on the already existing systems, an enhanced system is hereby proposed. Individuals/tax payers will have to register on the system. On the online forms, they will provide all necessary details. On confirmation of the details provided by the tax authority, the administrator would verify the taxpayer's registration details and an account will be created. Once an account is created, the fingerprint of the person will be captured and his/her BVN matched with the biometric details; then, the payer's account page is created after a successful registration and validation of details online. For employee, the administrator will have to create a company account with a single company administrator who may be the company's accountant. The company administrator in turn then creates accounts for each of the staff in the company with their biometric and BVN matches. This enrolment of company staff is done online by the company's administrator in the comfort of his office. The company administrator also schedules and makes payments on behalf of the staff and can update their details when necessary. The company will however create a separate tax account for the payment of their annual corporate taxes. The tax authorities' systemadministratorscan have access to the registrations and payments details of all users. It is important to note here that during registration, the FIRS will systematically be getting taxable individuals into the tax net and as well building up the taxpayer's database, matching each account with the unique attributes of captured fingerprints and BVN. On the verifications, the tax authorities will use this platform to verify tax payments statuses of individuals and companies. The fingerprint and BVNwill be verified and matched against the tax details on the database. This will be the authentication process. Users whose data exist in the databases will be verified, while users who are yet to enroll will be redirected to the registration platform. This verification process couldbe made compulsory in any governmental institution as well as banking system by means Plug-in whereby tax invaders will have no room to hide other than getting them into the tax net. Tax and rate agents will be trained and equipped with Smart Card reader capable of capturing and interpreting fingerprints (Just like the INEC's SCR). The SCR will also be able to link-up with the tax authority's database of taxpayers. The agents will verify taxable adults within their respective jurisdictions in order to ascertain those who have paid their taxes and those who have not, through the authentication process. The agents will also be able to remotely enroll defaulting taxable adults on the go. This system will drastically reduce tax evasion, increase compliance and consequently increase the income yield of the FIRS.

Taxpayers Enrollment and Authentication/Verification Process Flow

The basic process flow for biometric enrollment, verification and identification is as follows:

i. A user initially enrolls in the tax authority's online portal providing biometric data and BVN which is then converted into a template,
ii. Templates are stored in the taxpayer's database for the purpose of subsequent comparisons,
iii. In order to be verified or identified after enrollment, the user provides biometric data, which is then converted into a template,
iv. The verification template is compared with one or more enrolled templates,
v. The result of the comparison among biometric templates is rendered as a score or confidence level, which is compared to a threshold used for a specific technology, system, user or transaction,

vi. If the score exceeds the threshold, the comparison is a match, and that result is transmitted and

vii. If the score does not meet the threshold, the comparison is a non-match, and that result is not transmitted.

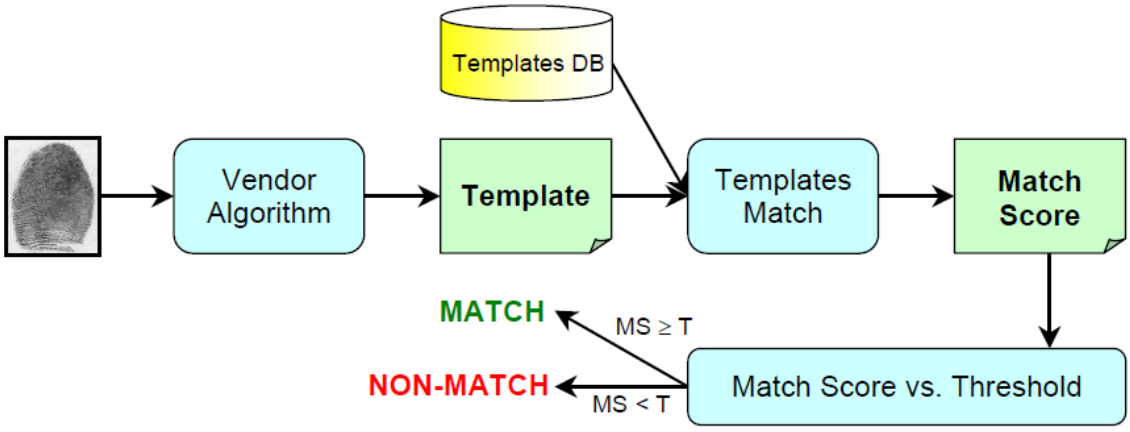

Figure 4:Biometric matching Process Flow Diagram

However, those who fall under the NON-MATCH category will be referred to registration platform or enrolled on the go.

CONCLUSION

The desire to mitigate the rate of leakages and diversions of public generated revenues, improve the rate of voluntary compliance in paying tax and digital inclusiveness in revenue generation services has motivated this work. We have through this work provided a platform that helps in fighting corruption in the revenue generation sector which for a long time has been a critical societal problem. This research presented the development of fingerprint authentication and payment system for sensitive organization like tax organizations. Cheaper optical fingerprint scanner, open source fingerprint system development kit (SDK), visual studio 2010, Dreamweaver, PHP and MySQL (open source) backend database was employed. Comparative study was instigated on related products especially in developed countries. During the study, it was discovered that similar systems were developed and implemented but among the systems, quite a scarce number implemented it in combination with biometric authentication. Those applications improved security in respective security's operation area. To model this application Use case diagram, activity diagram, DFDs and class diagrams were used. The Use case diagram was used to define users, roles, processes and their relationships. Activity diagram illustrated business case while data flow diagram detailed the logical flow of activities or information in the system. For example, DFDs helped us to understand the process of digital image processing in fingerprint biometric verification system. Fingerprint biometrics verification system has two important processes namely enrollment and authentication. The Electronic Tax payment and Verification system is not a new system, but a rather local solution to a problem with global purview. Individuals can depend on this platform to carry out their dutiesas citizens.

RECOMMENDATIONS

The system meets desired expectations but would perform better if the following recommendations and suggestions are considered:

i. The software is designed to accommodate the needs of its scope of study and as such implementation outside this scope could be limited. But bearing in mind possible implementation outside the definedscope of study, can easily be modified to accommodate the needs of implementation environment.

ii. The E-taxation system can also be interfaced with other governmental

agencies and institution to furnish them with information that wouldn't necessarily be available to them.

iii. The E-taxation system should be implemented in a secured server environment as it contains several important information about its users

iv. The E-taxation system can also be used by the government to provide more accurate estimates about the income pattern of its citizens and their response to the implementation of new tax policies.

v. It is recommended that the relevant authorities will enact the appropriate laws so that the Bank PlugIn will become operational in order to bring punitive measures to tax offenders.

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