

Integrated Web-Based Voter Registration System (For Developing Countries)

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Abstract:- Voter registration which is one of the major tools for election in most democracies is simply the procedure that qualifies a citizen to vote and be voted for in any given election. This tool greatly determines both the success and the credibility of any election. Faulty voter registration will automatically mean faulty election. It also becomes a veritable tool in the side of both the election body and the political system. It serves as a guide in the electoral strategies. Irrespective of the great importance of voter registration, the system has been bastardized by anxious politicians. This has led to loss of confidence in the voter registration system. This dissertation critically examines how voter registration could be made more effective and reliable on the assumption that, there should be a standard national database which would in turn be integrated with a web-based voter registration system. This will enable for voters' authentication using the existing databases. Based on the assumption, this dissertation creates an integrated database by filtering data from the simulation of National Population Commission database (NPCDB), National Identity Number Database (NINDB) and Nigeria Communication Commission Database (NCCDB). The database application used to link the software with relevant data in the system so developed was my SQL. The system designed was analyzed with Structured System Analysis and Design Methodology (SSADM) using waterfall method, and Object Oriented Methodology (OOM). The system was developed with PHP and HTML scripting languages. The essence of the design was to automate voter registration process and register citizens automatically once they meet the minimum requirements as contained in the electoral act of the nation. This is hoped to encourage total participation in voter registration as well as voting. The system was designed with four main modules (integrated database, automatic voter registration, direct voter registration and electronic offline voter registration). The system could detect double/multiple registration as well as authenticate a voter before registering.

I. INTRODUCTION

Living things from creation are saddled with two roles; leadership and followership, which are more significant in mammals especially the primates. Humans, being have organized way of selecting their leaders. Leadership sometimes is inherited, appointed, elected or exhibited. [14] summarized types of leadership as follows; tribal leadership, leadership based on fear, family leadership, pre-classical leadership, classical leadership, progressive leadership, and post progressive leadership.

The aim of leadership is to exercise control over a group of persons defined with common features, aspirations and goals. The essence of leadership is to collectively arrive at the set goals and aspirations of the group. Leaders serve the role of coordinators and skilled experts [14]. Leaders are thereby endowed with the authority to exercise power and control over their group to ensure that members are disciplined toward achieving the set goals and aspirations of the group.

Humans are of deviant motives corruption tendencies and will always want to force their ways into sit of power if no adequate measures selections are put in place. Based on this, was the introduction of a set of rules (constitution) that governs the way the leaders are selected. Modern leadership styles according to [2] include; the pace setting leadership, the authoritative leadership, the facilitative leadership, the coaching leadership, the coercive leadership and the democratic leadership. This research work focuses on one of the leadership styles in managing a larger population whereby the people decide who their leader should be, called "democratic leadership". In a democratic setting, leaders are elected into public offices through majority opinions of the electorates expressed through voting. Democracy is a system such that every individual has control over his or her vote, as such, votes counts. In a democratic setting, leadership is by election which is done as specified in the electoral act of such country and enforced by a commission that is charged with electioneering process. Within a given space of time, the commission initiates a process that leads to the selection of leaders to occupy various elected positions in the society.

One of the major procedures in an electoral process in most democracies is the voter's registration. It is the registration of eligible citizens who qualified to vote and be voted for in an election as contained in the electoral act of the land. The manner of handling this viable tool (voter's

registration) for election of officers into public offices in most cases lacks credibility, standard, reliability and efficiency. As a result, influential or men at the corridor power force themselves on the people at against their wish. This will lead to unscrupulous acts resulting in election rigging, holding tight to seat of power, falsehood, etc.

In the context of the African man, leadership is a do or die affair [12]. This is a wrong perception, as such; an African man must be guided by strict rules and laws to conform to the norms of the society.

Electoral laws have been in existence with several reforms, but have failed to deliver in the developing and under-developed countries, even in some developed nations, a genuine free, fair, and credible election. A more authentic and efficient means of correcting the misnomers in the electoral process, is the introduction of Information Technology (IT) into the electoral processes beginning from the voter registration system. The role of computer technology in rebranding the entire system cannot be over emphasized, let alone electoral reformations [10].

Computer provides speed, accuracy, efficiency, portability, timeliness, adequacy and above all, security in its tasks. Based on this, Minnesota's legislature passed bills HF1053 and SF660 in 2009 which require that residents who have state ID or driver's license should be registered automatically and this was expected to address the problems of; low voters participation, inaccuracies in voters rolls, voter discrimination and disenfranchisement, wrong purging of eligible voters, time and fiscal cost and potential fraud, [6].

II. AIM AND OBJECTIVES OF THE STUDY

The aim of this research work is to develop an integrated web-based voter registration system for developing countries. The objectives of the research include the following; to develop a system that should be able to;

- Create a more reliable integrated National database from the simulation of the existing national databases (National Communication Commission (NCC), National Identity Number (NIN) and National Population Commission (NPC))
- Automatic register of voters using the phone number and or email as contained in relational (integrated) database.
- Authenticate voters and eliminate double/multiple and non-indigenes registration.
- Deliver timely voter registration exercise.

It is expected that this research work would be of help to the government and any agency seeking to practice genuine democracy.

III. LITERATURE REVIEW

This chapter focuses on the review of related literatures, journals, books, etc. on voter registration system considering both manual and computerized voter registration. This review enhances effective and efficient analysis and design of the proposed system.

A. Concept of Voter Registration System

In most democracies, one of the major tools for election of leaders into public offices is the voter registration. Voter registration is the requirement in some democracies for citizens and residents to be registered specifically for the purpose of being allowed to vote in election. Voter registration is the process of identifying citizens eligible to vote in an election and compiling their personal details in a list called register of voters [7]. It is a system that determines the voting strength of a country which guides the body responsible for the conduct of elections and political parties on how to plan and program the election for success.

Voter registration which is the first step in credible and free election in a democratic society is the right of an individual to participate in any given election to exercise his or her franchise. Voter registration is concerned with the right to vote, [8]. According to [5], the essence of voter registration is to;

- Restrict access to voting
- Ensure that only those entitled to vote in a given jurisdiction can do so
- Ensure that each voter votes only once
- Voter registration list can be used to determine the best location for polling place and to know how many voting stations, and poll workers are to be assigned to a given polling place, voter turnout, etc.
- Government agencies may use voter lists, for example to help jury pools.
- Political parties and candidates also use the lists for campaign related activities.

[7], opines that voter registration varies from country to country but its cardinal objectives are, to guarantee and enable all those legally qualified to vote to do so; prohibits unqualified persons from voting by ensuring that only qualified voters are registered; and prevent voters from voting more than ones at any once election and ensure equality of the votes.

Voter registration originated in the early 19th century as a method of disfranchisement. Many immigrants were involved in local elections in the US which became an issue of concern. The only way of disfranchising the non-indigenes then, was through the registration of indigenes which automatically de-enlisted foreigners limiting them from voting [8]. Massachusetts became the first to enact voter registration law in 1801, which was followed by other countries thereafter [5].

Voter registration system is formulated by electoral body charged with the conduct of elections in a democratic society. The electoral processes are appropriated by the electoral laws. The Electoral Act defines the status of a citizen who is qualified to vote and be voted for and specify the criteria for voter registration. These criteria are basically, age limit, sound mind sets, indigene and legal disposition of citizens either bound by the law due to any civic or moral injustice or religious embargo.

Voter registration is a pointer to election. In a questionable voter registration process, the outcome of the results of such an election would equally be questionable. [1] is of the opinion that free and fair election cannot be undertaken without a proper verification on the voter's fulfillments of legal requirements. Voter registration must be seen as a catalogue of citizens who have right to vote. Any doubt cast on voter registration can stain the election results.

Voter registration is practiced differently in different countries. What is important is that the operation is backed up by the law of the land (Electoral Act). In some countries, including most developed countries, registration is the responsibility of the government, either local or national; and in some, voting is compulsory and is required as part of each citizen's civic duty. Even in many countries where the voting itself is not compulsory, registering one's place of residence with some government agency is required, which automatically constitutes voter registration for citizens, and in some cases residents, of the required age. In other countries, however, people who are eligible to vote must "opt in" to be permitted to participate in voting, generally by filling out a specific form registering them to vote. Government's registering people has been shown to be one of the most powerful predictors of high voting turnout levels [13].

Voter registration system such as same day registration also known as Election Day Registration as practiced in the US. Ten states do not require advanced registration, instead allowing voters to register when they arrive at the polls or, in the case of North Dakota, eliminating the registration step altogether. Same-day registration (SDR) has been linked to higher voter turn-out with SDR states reporting average turn-out of 71% in the 2012 United States Presidential election, was above the average voter turn-out rate of 59% for non-SDR states [1].

B. Features of Voter Registration

The features of voter registration are briefly discussed as follows;

➤ *Universal*

Every adult person belonging to the citizenry should be registered. The crucial question of who is a citizen becomes an issue of discussion, not withstanding, this is defined by the electoral act where such practice is obtained. Most countries insist that citizenry should consist of those individuals who are natured by the territory with those who are naturalized; while some argue that citizenry for voter

registration should be those who are resident in the land by the time of the registration and are within the voting age [3].

➤ *Equality*

The vote of every citizen should have the same value without discrimination.

➤ *Direct*

The right to vote should be personally exercised by every individual citizen at the polling station.

➤ *Secret*

Secrecy of the vote must be guaranteed both legally and in practice. This gives a wholesome practice not allowing the interest of others to overshadow or influence the decision of the other voters [9].

C. Structure of Voter Registration

➤ *Election Administration Body*

Voters registration is formulated by the national electoral body and approved by the National Assembly as in the case of Nigeria. The formulation encompasses the nature and the conduct of voters registration exercise, durations and anticipated outcome, financial projections as would be required in the exercise, etc. Once the approval is given with a backup fund from the government, public announcement is made stating the anticipated programme for the voters registration exercise by the electoral body (Independent National Electoral Commission (INEC) in the case of Nigeria).

➤ *Regulations for Voters Registration*

The electoral body of the country list specifications with respect to voters' registration. This is done by organizing public hearing, stating the true position of voters' registration on the face of the constituted authority and encouraging citizens to abide. The electoral commission goes further stating the "Dos and Don'ts" as expected of each citizen in the forthcoming voter registration exercise. As at 2006, the Electoral Act of the Independent National Electoral Commission (INEC) stipulated the following certificates for a qualified registrant according to [7];

• *Qualifications*

A person shall be qualified for registration if such a person:

- ✓ Is a citizen of Nigeria
- ✓ Has attained the age of 18 years or above on or before registration date
- ✓ Is ordinarily resident in, works in or originates from the Local Government Area or registration area or ward covered by the registration centre
- ✓ Is not subject to any legal incapacity to vote under any law, rules or regulations in force in Nigeria
- ✓ Presents himself/herself to the registration officers for registration.

- *Where can a Person Register?*

A person can register only once and at a registration centre designated by the Commission, in the area where he/she;

- ✓ Resides,
- ✓ Works in gainful employment, or
- ✓ Originates from (i.e. an indigene).

- *Voter Registration Period*

The registration of voters is usually by stipulated time frame by the electoral body.

- *Hours of Registration*

Registration of voters is also within a stipulated period per day.

- *Display of the Register*

After the registration exercise, the Permanent Voters Register List (PVRL) is displayed for public scrutiny at every registration centre for a period of not less than five days

- *Programme/Planning for Voters Registration*

The electoral body to meet up with voter education; develops programme of events, employs ad-hoc staff, trains staff, purchase materials required for the exercise, etc. By this, it is expected that the electioneering body is set to commence the exercise. Materials and people (workers) are thereafter moved to various locations as contained in the program for full implementation of the exercise. Security measures are as well adequately put in place to ensure that citizens' rights are protected as well as electoral workers and property. This will help in the sustenance of the anticipated voters' registration lists.

- *Voters Registration Exercise*

This is concerned with the commencement of the voters' registration where adequate publicity is made and voters turn out en-mass to be registered. This can take the form of manual registration as in the case of the developing countries where the voter and the registration officer meet face to face and collect the voter's details. This exercise continues until the anticipated masses are entirely enrolled or the stipulated period has expired. In most cases, after the stipulated period expires, there is addition of some weeks for the continuation of registration tagged "mop-up registration". At the end of the exercise, all data are collated unit by unit, Ward by Ward, local government by local government and state by state to form the voters' registration list (database of voters) for the anticipated election.

- *Voters Registration List*

Voters registration list as discussed earlier is the voters register in any given political dispensation which is used as a worthy guide for any given election.

- *Continuity*

Voters registration exercise in a standard system is continuous and done automatically once a citizen clocks the stipulated age (of 16 to 18 as the case may be) and is of sound mind, void of any incrimination (not bared by any legal act), while for developing countries like those of Africa, voters registration is periodical (that is, each election season or dispensation) [7]. This becomes wasteful and is manually based, which gives rooms for maneuver by hungry and desperate politicians.

IV. SYSTEM ANALYSES AND DESIGN METHODOLOGY

The study was analyzed with a merged methodology of Structured System Analysis and Design Methodology (SSADM) using waterfall model, and Object Oriented Methodology (OOM). Both methods were employed to bring out detailed description of the system as well as providing avenue for easy modification of the system as need may arise in future.

A. System Analysis

This study seeks to provide efficient and effective ways of going about voter registration void of huge cost, double/multiple registration, encourage total registration and eliminate totally the stress involved in voter registration in the developing countries using INEC Nigeria as a case study.

- *Analysis of the Existing System*

The modus operandi of the existing voter registration system is as follows:

- Franchise-able citizens move to accredited polling units of their convenience
- The voter registration officers conduct the voters who arrived accordingly
- The registration officer begins the registration by collecting voters' records and biometrics one after the other.
- On completion of each voter registration, a temporal voter card is printed for the voter.
- Each registered voter's details are maintained in both softcopy (in the computer) and on manual voters register.
- At the end of the day's registration, a list of voters registered for the day is printed to match up with the manual register.
- At the end of the entire voters registration exercise, voter lists generated from each polling units are submitted to the local government INEC head office for onward submission to the state INEC headquarter.
- Registration details are collated according to polling units, registration area, and local government areas to form the state voters' registration list.
- Each state submits a copy of its voters' registration list to INEC headquarters Abuja for onward processing, generation of permanent voters' card, election, etc. See Figure 1.

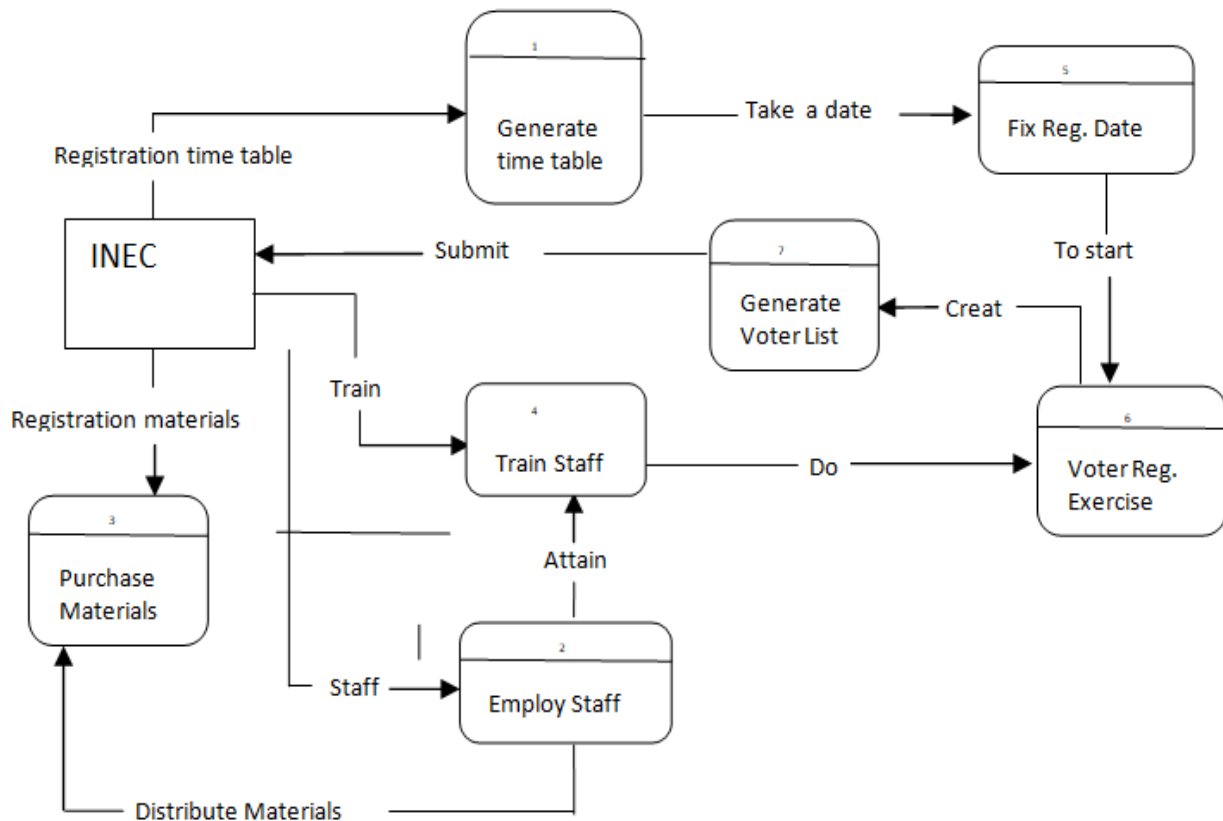


Fig 1:- Data Flow Diagram of the Existing System

➤ *Limitation of the Existing System*

The old system was partly manual and partly computerized, but was not networked. The following were the constraints associated with the old system;

- Double/multiple registration of voters leading to false results in election
- Discouraged total registration of citizens thereby paving ways for inefficiency
- Lacks adequate control of who is to or not to register
- Time wasting on the part of INEC and the people
- Paves ways for violence, intimidation and threat
- Wastes funds and resources
- It is inefficient, ineffective and unreliable
- It lacks security and dependability.

➤ *Analysis of the proposed system*

The propose system consists of four modules; the Integrated Database created from the simulation of three national databases; Nigeria Communication Commission, National Population Commission, and National Identity Number (NCC, NPC and NIN), Direct Voter Registration, Automatic Voter Registration and Offline Electronic Voter Registration.

The modus operandi of the proposed voter registration system is as follows:

- Citizens data populate automatically from existing national databases to form authentic database of citizens.
- From the database, citizens who are of voting age are notified for voter registration automatically.

- Voter registration is initiated automatically.
- Voter respond by providing needed data electronically.
- Data collected is authenticated from the database. A reply is forwarded through the same avenue stating details and advice as may be needed.
- On successful registration, the voter details are posted on the voter list with the voter secret identities for future used. While the voter’s access codes are send to him or her.
- The voter can log in to his profile and do allowable editing such as change of area and limited correction of names.
- In areas where there is no network, electoral officers visit such areas periodically and capture voters’ details in direct voters electronic form template.
- The data captured during direct voter registration is subjected to authentication. Those who are authenticated are added to voter’s list.

B. System Specification

This explains the core of software and hardware components requirements and specification used in developing the system. The requirements outlined here are the minimum for actualizing this system.

➤ *Software Requirement*

The minimum software required for this system is as follows;

- An entire new system is developed with front end/Graphic User Interface (GUI) tool which requires PHP and HTML with Dream Weaver as a background

platform. Each component is treated as an object and runs on net, therefore, for proper integration; net programming languages such as PHP and HTML are used to build an interactive interface.

- The Relational Data Base Management System (RDBMS)/Back end requires my SQL Server-2005.
- The operating System is Windows Environment (Vista, Win7, Win8,etc), and mobile operating system environment (Android, java, etc)
- The system requires window based browsers such as Google, Internet Explorer, Mozilla Firefox, etc.

➤ *Hardware Requirement*

This include computer systems, portable and handheld mobile devices, with under listed minimum hardware requirements or its equivalent;

- INTEL PIV 3GHZ (100 FSP) MMX or higher
- 2GB RAM with 500GB Hard Disk free space
- Flat Screen Monitor
- USB keyboard and Mouse
- Fully multimedia and networked systems

C. *System Design*

This stage defines issues the way there are, and the way things are done.

➤ *High Level Model of the Proposed System*

This entails developing a model to identify the data elements, components, that require web-based automation and data flow to represent the logical design of the proposed system.

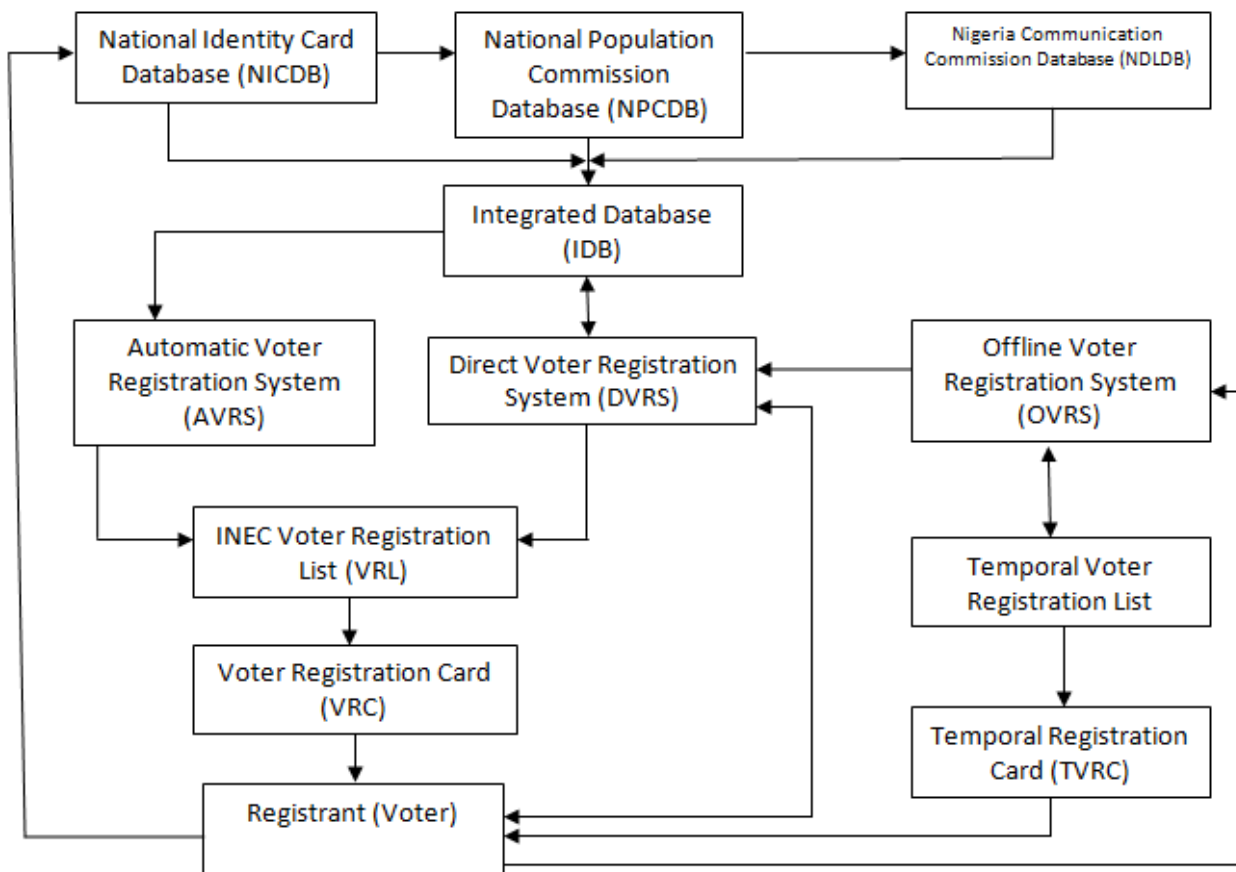


Fig 2:- High Level Model of the Proposed System

The diagram above represents the proposed system. It is made up of four (4) subsystems (Integrated Database (IDB), Automatic Voter registration System (AVRS), Direct Voter Registration System (DVRS) and Offline E-Voter Registration System (OVRS)). Fig 1 is detailed as discussed in the analysis of the proposed system.

➤ *Use Case Description of the Proposed System*

The Use Case design below was adopted from the work of (Whitten, Bentley, and Dittman, 2001, pp 679-682).

- *Use case Name*:- Web-Based Voter Registration
- *Actors*:- Voter, INEC and Admin

• *Description*

This Use Case describes how voters can be queried from an integrated database, and message send to voter who in turn responds by sending in his or her passport which is verified from the database and the voter registered automatically.

TYPICAL COURSE OF EVENT	
ACTOR ACTION	SYSTEM RESPONSE
1. INEC fixes a voter registration date and Time for registration to comment send to WBVRS.	2. IDB is queried, list of prospective voter generated and registration message send To Citizen.
3. Voter login to www.eneji-inec.com	4. A login window displays requesting user to select options (check status, update record, change passcode, admin login)
5. On the selection of “check Status” by voter	6. Check voter status and give registration details
7. On the selection of “update Record”	9. match phone number with database and allow user update RA, PU and send passport
12. On selection of “Change Passcode”	10 Biodata process and voter registered automatically.
15. On selection of “Admin Login”	11. Database updated
18. On selecting Logout by Admin	13. Change passcode form display for voter requesting new passcode
20. On selecting “Manage User”	14. New passcode updated in the database
23. On selection of “Change Passcode”	16. The admin login window displays requesting Admin’s access code
26. On selecting “polling Units”	17. The following options are displayed on the screen for (Logout, Change Passcode, Manage User, Polling Unit, Wards, Automatic Voters’ Registration, Direct voter’s Registration, Generate Voter’s List, Generate Voter’s Card)
29. On selecting “Wards”	19. The system exit to windows desktop
32. on selecting “Automatic Voters’ Re-gistration”	21. The add new user form will be displayed for new user data to be added.
33. Admin fills required details and click “Fresh Registration”	22. The new user added is updated in the database table of admin user.
35 Admin fills in required details and click On “Update Existing Registration”	24. A change passcode form will display requesting for old and new passcode
37. Voter send in Passport	25. The new access is updated and stored in the database.
41. on the selection of “Direct Voter Registration”	27. The PU form window will open for Admin to fill in a new polling unit accordingly.
43. On the selection of “generate report”	28 the new PU is created and updated in the table of PU in the Database.
	30. The Ward form window will open for Admin to create new wards accordingly.
	31 The new Wards created are updated in the table of ward in the Database.
	32. The AVR form window will display requesting admin to select year of registration, and range.
	34. System send registration request to all qualified prospective voter in the list.
	36. Sends registration request to only those who have not receive registration request before.
	39. Passport is process and voter registered
	40. Voter added or updated into database
	41. DVR form window will display requesting to be filled by the Administrator.
	42. The voter details are authenticated and save.
	43. “Generate Report” form window will display requesting for range for report to be generated.
	44. The voter registration list will be filtered from the database and presented in the range and category requested.
	45. On the selection of “Generate VoterCard”
	46. “Generate Voter Card” form window will display requesting for range of card to be generated.

Table 1:- Use Case Design of Propose System

- PRECONDITION:-Voter has to register with any of NCC, NPC, or NIN to be qualified to vote and use the system
- POST CONDITION:- Voters who are registered will have a confirmation notice generated and sent to their phone number and or email address.

➤ *System Interface Design*

The WBVRS interface designs are as follows.

- *System Login Interface*

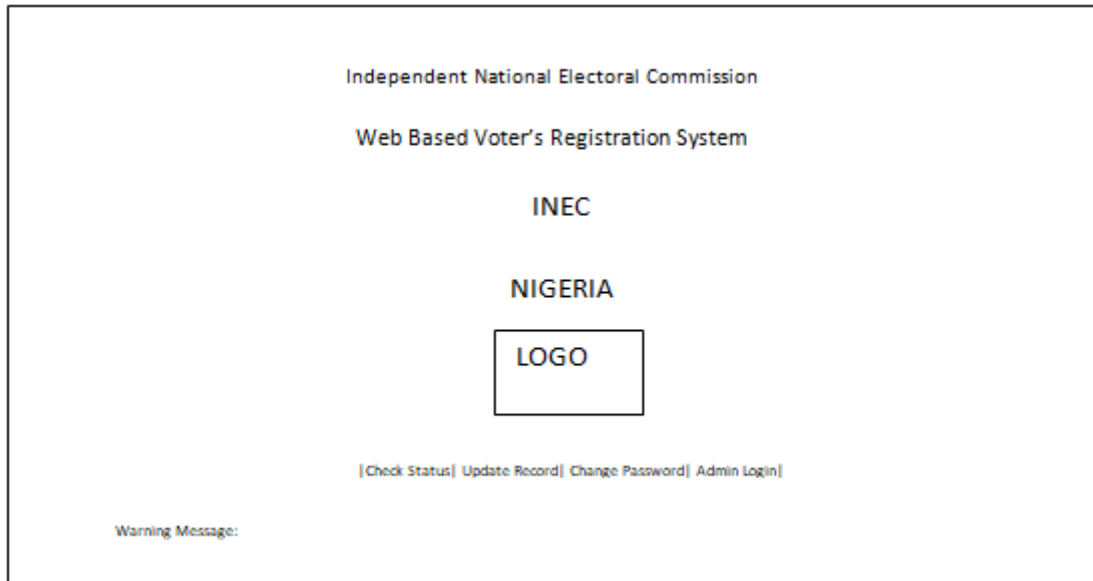


Fig 3:- Web-Based Voter Registration System Login Interface

On the interface are four links (Check Status, Update Record, Change Passcode and Admin Login) for users to

navigate according to the purpose of the login and the right to use.

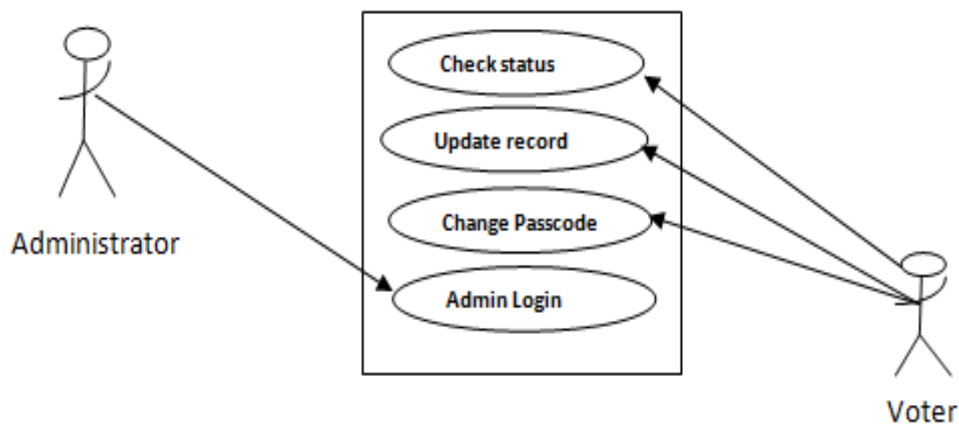


Fig 4.2:- Login Use Case Diagram of WBVRS

The Use Case diagram above shows two actors (Administrator and Voter) with the activities required to login. A brief description of the use case is as given below;

• *Admin Login Design*

Once a user logs in as administrator, he becomes the sole controller of the system and can do damages to some data if not controlled.

From the login interface, voter who is the WBVRS system administrator logs in by selecting “Admin Login” command. A form window is displayed requesting administrator’s user name and pass word which if correctly supplied will log him into the administrator’s page, other display error code requesting for correct user name or pass word or both.

The image shows a web interface for 'Admin Login'. At the top center is a box labeled 'LOGO'. Below it is the text 'Admin Login'. The main form consists of three rows: the first row has a label 'User Name' and an input field; the second row has a label 'Password' and an input field; the third row has a wide input field and a button labeled 'Login'. Below the form is a link labeled 'Home Page'.

Fig 5:- Login Interface of “Admin Login”

• *Input Form Design*

The WBVRS administrator from his login page creates wards, polling units as well as offline voter registration which constituted the major input forms.

✓ *Ward Creation Form Design*

For dynamism, the system is designed such that Wards and Polling Units are created to curtail the teeming growing population of voters. The administrator of

WBVRS (INEC) uses this form to creates ward as the case may be. From the administrator home page, he or she clicks on Ward option. A ward creation form window will display. He then select the appropriate state, local government area from the dropdown list control and then in the text box, he provides the name of the ward to be created and select or click on “Create Council Ward”. The ward is then created and added to ward list in the database fig 6.

The image shows a web interface for 'Create Council Ward'. At the top center is a box labeled 'LOGO'. Below it is the text 'Create Council Ward'. The main form consists of three rows: the first row has a label 'State' and an input field; the second row has a label 'Local Govt. Area' and an input field; the third row has a label 'New Council Ward' and an input field. Below the form is a button labeled 'Create Council Ward'. At the bottom center is a footer with the text 'Logout | Staff Home |'.

Fig 6:- Ward Creation Form

✓ *Polling Unit Creation Form Design*

The administrator of WBVRS (INEC) uses this form and creates Polling Unit as the case may be. From the administrator home page, he or she clicks on Polling Unit option. A polling unit creation form window will display. He then select the appropriate state, local government area,

and ward from the dropdown list control and then in the text box, he provides the name of the polling unit to be created and select or click on “Create Polling Unit” command. The polling unit is then created and added to polling unit list in the database fig 7.

The image shows a web interface for 'Create Polling Unit'. At the top center is a box labeled 'LOGO'. Below it is the text 'Create Polling Unit'. The main form consists of four rows: the first row has a label 'State' and an input field; the second row has a label 'Local Govt. Area' and an input field; the third row has a label 'Council Ward' and an input field; the fourth row has a label 'New Polling Unit' and an input field. Below the form is a button labeled 'Create Council Ward'. At the bottom center is a footer with the text 'Logout | Staff Home |'.

Fig 7:- Polling Unit Creation Form

✓ *Design of Direct/Offline Electronic Voter Registration*

During registration, voters who lack ICT facilities in their terrains are registered using electronic offline voter registration form templates. The WBVRS administrator from his home page click on Direct Voter Registration and

a form window for voter registration will load. The voter records are filled in including the bio-data, after which the registration officer clicks on “Register Voter” command. The voter is registered provided the data supplied are authentic fig. 8.

Direct Voter's Registration Form	
Phone Number	
Surname	
Other names	
State	
Date of Birth	
State of Origin	
Local Govt. Area	
Electoral Ward	
Place of Birth	
Address	
Kinship Person	
Gender	
Document Used	
Document Number	
Register Voter	
Logout Staff Home	

Fig 8:- Offline Voter Registration Form

• *Output Form Design*

During voter registration exercise as announced by the appropriate authority, the following outputs would be achieved with WBVRS; voter registration list and voter identity card

• *Voter's Registration List Generation Design*

The WBVRS administrator clicks on “Generate Voter’s Registration List” from the staff home. A form window will display requesting administrator to enter state, local government area, ward and polling unit from which list is to be generated for. As the administrator fills the form appropriately, he pick the range for which list is to be generated either by state, local government, ward or polling unit fig. 9.

Commission's Address						
S/N	ID NUMBER	SURNAME	OTHER NAMES	BIRTH DATE	SEX	REGISTRATION DATE

Fig 9:- List of registered Voters

V. SYSTEM IMPLEMENTATION

The system is implemented in two forms; the automatic voter registration which filters voter information from the integrated database, and the offline voter registration which is used for direct data capture in network absence locality. The captured data is latter authenticated for voters' authenticity.

A. User Interface Implementation

This consists of interfaces obtained from the test running of the designed system.

B. Main Menu Implementation (System Login)

The log in being a web-based application logs in users to the interface as shown in fig 10. The user can log in as prospective or active voter or administrator of WBVRS.



Fig 10:- WBVRS “Login Interface”

➤ *Admin Login Implementation*

Once a user logs in as administrator, he becomes the sole controller of the system and can do damages if not controlled. The administrator login from the WBVRS login

window by clicking on “Admin Login”, and then supplying genuine user name and password as will be requested fig. 11.



Fig 11:- Login Interface of “Admin Login”

C. Input Form Implementation

The WBVRS creates wards, polling units as well as offline voter registration which constituted the major input forms.

➤ *Ward Creation Form Implementation*

The administrator of WBVRS (INEC) uses this form and creates wards as the case may be. The administrator from the links provided in the ward creation interface would select the state, local government, then key in name of ward and select by clicking on the control **create ward** and ward will be created and added to the database fig. 12.

Fig 12:- Ward Creation Form

➤ *Polling Unit Creation Form Implementation*

The administrator creates a new ward by; select state, local government area, ward, and then type in the new polling unit of interest, reaffirm the polling unit and click

create polling unit from the control button and the polling unit will be automatically created and added to the existing polling units13.

Fig 13:- Polling Unit Creation Form

➤ *Direct/Offline Electronic Voter Registration Form Implementation*

During registration, voters who lack ICT facilities in their terrains are registered using the offline voter

registration form. The voters' details are collected electronically on voter registration template as seen in fig. 14.

Fig 14:- Offline Voter Registration Form


D. Output Form Implementation

At the end of voter registration exercise, the following outputs is achieved with the proposed system; voter registration list and voter identity card

➤ **Voters List Implementation**

Once registration exercise is over, the system automatically creates a database of registered voters

(Voters List) according to polling units, wards, local government areas, States and National. Voters list can now be generated according the required level. This is done by the administrator selecting generate voters list and after specifying the bounds. A sample of voter list generated from the database is shown in fig. 15.



Independent National Electoral Commission [INEC]
30, Mohammed Babangida Crescent, Suleja, Abuja

EBONYI STATE OF NIGERIA
VOTERS' REGISTRATION LIST

S/N	ID NUMBER	SURNAME	OTHERNAMES	BIRTH DATE	SEX	REGISTERED
1	07032266611	Okoye	C. I.	1951-12-22	M	2014-02-27
2	07033575936	LAWAL	OLAIDE AHMED	1959-01-10	M	2014-02-27
3	07034375570	ENEJI	SAMUEL	1955-05-10	M	2014-02-27
4	07034477250	Alo	U. R.	1963-03-24	F	2014-02-27
5	07036597010	Mbam	BCE	1947-03-12	M	2014-02-27
6	07036673324	Agana	Moses A.	1974-06-09	M	2014-02-27
7	07057352839	Ogah	Ogbonannaya S.	1975-03-02	M	2014-02-27
8	08022243197	Nwali	Peter A.	1962-01-21	M	2014-02-27
9	08025636540	Ituma	C.	1964-02-04	M	2014-02-27
10	08029926630	Idiege	Edward E.	1951-03-22	M	2014-02-27
11	08032686461	Nwode	Sunday N.	1980-05-30	M	2014-02-27
12	08034311177	Onu	F.	1961-06-30	M	2014-02-27

Fig 15:- A Typical List of Registered Voters

➤ **Voter Registration Card Implementation**

To generate a voter’s card, the administrator logs in as admin and requests for voter registration card by selecting the category (i.e. polling unit by polling unit) fig. 16.

VI. SECURITY FEATURES OF THE WBVRS DATABASE

WBVRS has been built around a large body of database that grows as time counts. Politicians would go any length to ensure that they manipulate the voter registration, if possible alter the database to achieve their dubious intentions. It becomes therefore necessary that a sensitive database of this kind should be adequately protected to grant confidence in its applications.

The following are the security features of this system,

- A. The database software (My-SQL-2005) has its security feature such as encryption, authentication, security policies, integrity checking, and access restriction on tables which are inherent to the database developed in this work and serve as a security to this system.
- B. This work has been designed with strong control on access to the database by all users. Voters and administrators can only access forms through which they can submit their data and/or query the database to generate report as in the case of administrator; they do not have the access to manipulate the database. This is possible as the c-panel used in hosting the database is having network security provided by the service provider, meaning that, for an access to be granted to the database requesting editing, formatting, or any form of adjustment, the services of the internet service provider hosting the WBVRS as well as permission from the top officials of INEC would be needed.



Fig 16:- A Typical Registered Voter’s Card

- C. The system is also timed as voter registration is periodical, and once the time is over for voter registration, the web site is shut till a time when such need arises.
- D. The system has two paramount authentication measures which it uses to check who is using the system and guarantee the elimination of double/multiple registration;

➤ *Phone Number Authentication*

Once a voter's data has been filtered from the databases to the integrated database, such a voter becomes authentic and identified by his or her phone number and bio-data. In subsequent transactions, the voter is only expected to use his or her phone number. In the situation where the voter chooses to be smart and use a different phone number, there is a trigger in this system so developed, that takes the bio-data from the new phone registered and compare its signature with the existing records in the database, where there is a match, instead of registering the voter as a new voter, the new phone number is instead added to the phone number(s) of the matching record thereby increasing the phone numbers of the matching record by one and refusing a new registration. This prevents double/multiple registration.

➤ *Biometric Authentication*

In the course of voter registration, a voter is not registered because his data are captured in the database. A voter is only registered when his or her biometrics captured or received is matched with the existing from the database successfully. More so, the fingerprints of voters with more than one phone numbers are detected with the existing database to forestall multiple registrations. These provide the integrity security of the system.

E. The administrator who has a more control on the system is equally adequately authenticated to ensure he is the right person before access is allowed. This is done with the use of secured username and password.

F. Any voter whose records are not contained in the integrated database, (i.e. the voter did not register with any of national population commission, national identity card or Nigeria communication commission) is not registered with voter registration, hence there will be no link to reach him or her, and by so doing limits non citizen from registering.

The security features used in the WBVRS as discussed is in line with the work of the following; Murray (2010) who opines that, database software should be design to provide control, protect access to the contents of a database as well as preserve the integrity, consistency, and overall quality of the data.

He further stated that database should be design to;

- Ensure that only authentic users perform given activities at given times.
- Ensure physical security
- Ensure network security and

- Ensure efficient encryption and authentication of database

Cyan, Lane, and Polk (2005) summarizes database security to include;

- Data encryption
- Authentication method
- Authorization
- Access restriction on tables, view, synonyms, or rows.
- Security polices

VII. RESULT PRESENTATION AND ANALYSIS OF FINDINGS

The results generated and presented in fig. 10-16 were dully examined and compared with operational specifications to ensure that they meet specifications as contained in the objective. This was done in units till the whole system was tested and results produced accordingly.

Live data which was the phone number of voters in the IDB was used to send registration request to voters in the form of a text message. Most of those who got the message acknowledge the receipt of the request, but only three voters were able to respond by sending in their current passport photograph through the link as contained in the request message. The three voters were registered and a registration confirmation was sent to them. The registered voters' are shown in fig.15.

Voter who were already registered were refused multiple registration. Instead, they received a message "there is an error with your data input; maybe the phone number has been used by another voter. Please try again". Both correct and incorrect data were used for the testing and it was obvious that the system while running to produce result was able also to come up with an error message when wrong data was entered. In the cause of trying a prolong access without success, the system terminates the user and sends "page timeout" message issued which is a good security feature of the system.

The systems application uptime is such that it runs fast in carrying out a given operation. High storage capabilities offered in the database ensure that both input and output data are kept intact and secured from unauthorized access.

VIII. CONCLUSION

This system has been able to achieve successfully the development and implementation of Automatic Voter Registration for developing countries. It has as well been able to take care of most of the anomalies associated with voter registration as has been in practice by INEC.

The system may be seen as a threat to most politicians who would want to avail themselves with the weakness of the existing voter registration system to their selfish advantages. Notwithstanding, let's look at the collective interest of the entire nation and allow such a system that

has the potentials of repositioning our political stands as a nation for good governance. Flexibility, efficiency, economy, etc with the propose system is very high, as such; it should be encouraged for adoption and deployment.

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