# Computer-Based　Automated Voting Machine (AVM) for Elections in Nigeria

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## ABSTRACT

Voting is very crucial to democracy, the trust that each vote is recorded and tallied with accuracy and impartiality is the foundation of genuine democracy. Nigeria returned to democratic rule in the year 1999. Ever since then the electioneering process especially voting has been manual. This manual method of voting is associated with one problem or the other which always resulted to post-election violence. The 2011 general election which was adjudged as most free and fair election since 1999 was characterized with post-election violence because some people believed the election was rigged in some area to favor the incumbent president. Authors of this paper collected some data on the conduct of 2011 general election from thousands of the eligible voters that voted in 2011 general election. Data collected was tabulated and analyze and it was discovered that Nigeria needs an alternative voting system that will automate the manual method of voting. This paper then proposed a computer-based e-voting system (Automated Voting Machine-AVM) for future election in Nigeria. The system imitates the automated teller machines (ATMs) used by financial institutions for financial transactions.

*Keywords:*
*ATM (AutomatedTellerMachine), AVM (Automated Voting Machine), Democracy, DRE (Direct recording electronic voting), Paper based electronic voting.*

## 1. Introduction

Voting is very crucial to democracy; the trust that each vote is recorded and tallied with accuracy and impartiality is the foundation of genuine democracy. Nigeria returned to democratic rule in the year 1999. Since then the electioneering process, especially voting has been manual. This manual method of voting is associated with one problem or the other which always resulted to post-election violence. The 2011 general election which was adjudged the freest and fairest election since 1999 was characterized with post-election violence, because some people believed the election was rigged in some areas to favor the incumbent president.

Authors of this paper collected some data on the conduct of 2011 general election from thousands of the eligible voters that voted in 2011 general election. Data collected was tabulated and analyzed; it was discovered that Nigeria needs an alternative voting system that will automate the manual method of voting.

This paper then proposed a computer-based e-voting system (automated voting machine – AVM) for future elections in Nigeria. The system imitates the automated teller machines (ATMs) used in financial institutions. We have come to trust many of our financial transactions on ATMs (Automated Teller Machines). The push for electronic voting machines has been a benefit of the faith in ATMs.

This system will bring, among others the following advantages:

- Enable future election to be transparent to all stake holders
- Reduce the amount of money spent on election process
- Eliminate post-election violence in Nigeria
- Speed up election registration voting and vote counting
- Prevent the use of hooligans', ballot hijacking, and imposition of candidates on people by godfathers during electioneering process

Section 2 of the paper, literature survey, discusses some voting systems; in section 3 we present Data analysis and finding; section 4 discusses the overview of proposed AVM by the authors; section 5 gives conclusion and recommendations.

## 2. Literature Survey

Manual Voting System as Applicable to Nigeria

The current voting system in Nigeria is purely manual. With particular reference to the 2011 general election, the voting procedure is as follow:

- Accreditation of eligible voters in the morning between 8 am and 12noon.
- The accreditation is followed by the election proper where the voters will line up and cast

their votes by thumb printing for the candidate of their choice based on party logo.

- After the voting has concluded, the electoral officers in polling centers count the votes in the presence of party agents and some voters that are present at the conclusion of the election.
- The result is then announced and recorded in the form E08 signed by the INEC officer and party agents.

All the procedures listed above were carried out manually. After careful examination of the procedures, it was discovered that election riggers can perpetrate their evil act of rigging by using any means mentioned in section 1.0 of this paper. Authors of this paper also gathered information about 2011 election from general public with the use of a questionnaire.

## Paper-Based Electronic Voting System

Sometimes called a "document ballot voting system", paper-based voting systems originated as a system where votes are casted and counted by hand, using paper ballots. With the advent of electronic tabulation came systems where paper cards or sheets could be marked by hand, but counted electronically [1].

These systems included punched card voting, mark sense and later systems. Most recently, these systems can include an Electronic Ballot Marker (EBM) that allows voters to make their selections using an electronic input device, usually a touch screen system similar to a DRE Systems, including a ballot marking device can incorporate different forms of assistive technology. [2]

## A Direct-Recording Electronic (DRE)

A Direct Recording Electronic (DRE) voting machine records votes by means of a ballot display provided with mechanical or electro-optical components that can be activated by the voter (typically buttons or a touch screen), that processes data with computer software, and that records voting data and ballot images in memory components[4].

After the election it produces a tabulation of the voting data stored in a removable memory component and as printed copy. The system may also provide a means for transmitting individual ballots or vote totals to a central location for consolidating and reporting results from precincts at the central location. These systems use a precinct count method that tabulates ballots at the polling place. They typically tabulate ballots as they are casted and print the results after the close of polling [3].

## Public Network DRE Voting System

A public network DRE voting system is an election system that uses electronic ballots and transmits vote data from the polling place to another location over a public network. Vote data may be transmitted as individual ballots as they are casted, periodically as batches of ballots throughout the Election Day, or as one batch at the close of voting. This includes Internet voting as well as telephone voting [7].

Public network DRE voting system can utilize either precinct count or central count method. The central count method tabulates ballots from multiple precincts at a central location [8].

Internet voting can use remote locations (voting from any Internet capable computer) or can use traditional polling locations with voting booths consisting of Internet connected voting systems [4].

## 3. Data Analysis, Result and Finding

### Data Analysis

Data were collected based on collection of data on conduct of 2011 election in Nigeria from citizen across the six geo political zones. Data were collected through the use of questionnaire.

The summary of the data obtained was presents in table 1 and 2. Four thousand eight hundred and fifteen (4,815) questionnaires was distributed across the zone mentioned. Only three thousand nine hundred and fifteen (3,915) of the questionnaires were returned with responses to the questions. The result obtained from the returned questionnaire was then tabulated as follows:

**Table 1: Tabulated Data 1**

| AGE BELOW 18 | AGE ABOVE 18 | VOTED IN 2011 ELECTION |
|---|---|---|
| 932 | 2983 | 2718 |

**Table 2: Tabulated Data 2**

| QUESTIONS | AGREE | STRONGLY AGREE | DISAGREE | STRONGLY DISAGREE |
|---|---|---|---|---|
| Q1 | 50 | 20 | 3715 | 130 |
| Q2 | 100 | 3615 | 179 | 21 |
| Q3 | 2917 | 598 | 215 | 185 |
| Q4 | 98 | 313 | 2754 | 750 |
| Q5 | 63 | 3850 | 0 | 2 |
| Q6 | 1000 | 2854 | 41 | 20 |
| Q7 | 900 | 2976 | 19 | 20 |
| Q8 | 100 | 28 | 800 | 2987 |
| Q9 | 1346 | 2567 | 0 | 2 |
| Q10 | 52 | 6 | 600 | 3257 |

## Results

From the tabulated Data in Table1 it was clear that majority of the people that responded to the questionnaire are above 18yrs and also voted in 2011 presidential election. The tabulated data was then converted to charts using Microsoft Excels as shown in figure 1.The general response to the questions tabulated in table 2 was converted to chart as in figure 2.
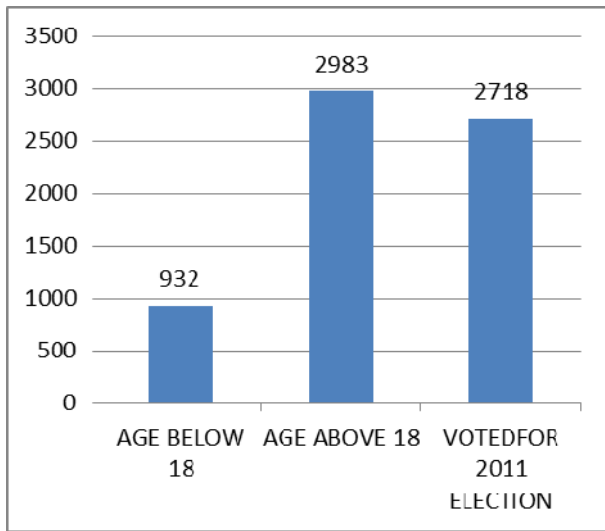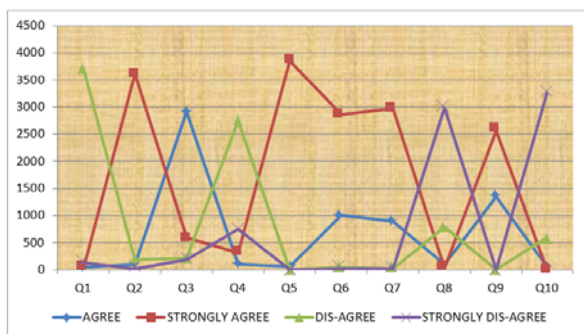


**Figure 1: Chart for table 1**



**Figure 2: Chart for Table 2**

## Findings

From the result of data analysis, we arrived at the following conclusions:

- That election was not rigged for President Good luck Jonathan, the PDP candidate for 2011 election.
- The voting procedure was cumbersome as voters had to be accredited first, and came back to vote later. Some voters that were not well informed believed they had voted after accreditation.

- The result of the election was exaggerated in some states of federation, especially in the south-south and south-east.
- Accreditation before election was not ok for majority of the people that responded to the questionnaire.
- Too much money was expended on the conduct of 2011 general election.
- Some people believed the result was rigged, which resulted to post-election violence in some parts of the country.
- Majority of the people preferred alternative way of voting for future elections.
- Majority of the people believed that manual voting was not ok for Nigerian elections.
- Many People wanted an alternative to manual voting (electronic voting system)
- 2011 general election was not massively rigged as believed by some people.

Consequent to the conclusions above, the authors then discovered that Nigeria needs alternative means of voting. The authors then proposed the design of Automated Voting Machine (AVM) that will automate the entire procedures in the future elections.

In a country like Nigeria some areas of concern regarding the new generation of computerized voting system are:

- Level of illiteracy in Nigeria;
- Epileptic power supply;
- Lack of ability to audit the quality of the software. The widespread believe that computer is always right is declining;
- Vulnerability of the system or of their supporting infrastructure to intentional attack or in advent errors;
- "Do or die" attitude of our political leaders.

In response to the concerns highlighted above the voting standard that serves as model of functional requirements that election system must meet before they can be certified for use in an election needs to be established. Nigerian government should make it a priority to educate her citizens in area of ICT (including awareness, knowledge & interaction). Government should declare state of emergency in power supply. Government must provide adequate security for the system before, during and after election.

## 4. Overview of AVM and Design Methodology

This AVM is a PC-based open source voting machine. The system imitates the ATMs used in financial

transactions, but this system will be in portable format that will be easy to carry to and from INEC (Independent National Electoral Commission) offices and polling stations, and it has a slot for voter's card which imitates the ATMs card reader.

The card automatically allows the AVM to identify, accredit, and allow eligible voter to vote and the results will automatically be stored and collated by the system. When a voter completed voting a receipt will be printed to confirm that he/she had voted. At the end of voting in each poling unit a special key designed to collate and print the result will then pressed by the head of polling unit from INEC. The result can then be signed by all stakeholders.

## 4.1 Hardware

This is the physical component of the system that we can feel and touch. A modern laptop size and its various components with slot for inserting the voters card which will allow the voters to log in to the voting system (machine) and vote. The components/features include:

- Monitor (LCD) 15" touch screen measured diagonally
- Input devices such as: touch screen interface, an LCDscreen, mouse, keyboard
- A smart card reader (voter's card reader)
- CD-R drive
- Printer
- Persistent EBI storage device for storing the result
- Special keyboard for physically impaired people

The prototype of the hardware is shown in Figure 3. The hardware is made up of the components LCD screen, keyboards, USB ports, touch pad, voters' card slot.

Voters insert the voter card into the slot and if access is permitted then voting process can proceed with or without system administrator assistance.
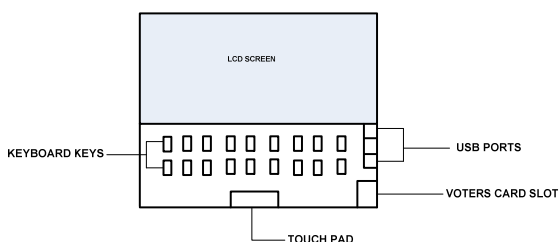


**Figure 3: Model of Proposed AVM System**

## 4.2 Software

The software is the driver to the hardware and user, which is classified into system software and application software [5].

System Software required is the operating system e.g. a stripped down distribution and the drivers for the installed hardware such as CD-R, printer etc. The operating system provides the user interface [6].

Application software required is the voting application program. This software allows the voters and INEC official to interact with the system. The application software will be designed with PHP and MySQL. This is necessary because the system may be interconnected in nearest future for online registration and collation of election result.

The head of the polling unit initializes the entire system at the beginning of voting. He/she will then print out the test document at the start of a voting day; this includes records of the public keys for the AVM for the day. The keyboard has some reserved keys specifically for the election; the keyboard is of 2types: the inbuilt keyboard for normal voters, and removable keyboard for blind voters. These keyboards have reserved keys common to both. The proposed special keys are:

(i) P - presidential election
(ii) G - Gubernatorial election
(iii) S - Senatorial election
(iv) H - Federal House of Assembly election
(v) C -Chairmanship
(vi) K - Councillorship election
(vii) I - State House of Assembly election
(viii) Return key - Cast vote

The interface that describes the manner in which the user interacts with the system is shown in appendix 1.

## 4.3 Future Research Direction

If this proposed system is designed and implemented, in future some biometric approaches such as fingerprint, voice recognition, facial recognition etc. could be introduced to enhance security.

## 5. Conclusion and Recommendation

There is no doubt that elections in Nigeria have been characterized by lots of problems here and there and no result of the election, especially presidential since 1999,go without being challenged at election petition tribunal. Some of the elections results like gubernatorial election in Osun, Ekiti, and Edo states in 2007 were reversed after some of the so-called elected governors have spent years lavishing the tax payers' money illegally.

The amount of money expended in conducting elections is very huge, and the results of the elections are always not acceptable to individuals or some groups of people. Even the 2011 general elections that were adjudged the

freest and fairest election since 1999 were characterized with post-election violence.

Problems associated with elections could be eliminated completely if the manual process could be replaced with computer based Automated Voting Machine (AVM) in the future elections, because it will create reliable, cost-effective electioneering process, thereby leading to a focused and genuine democracy that will bring about unity and peace in our country.

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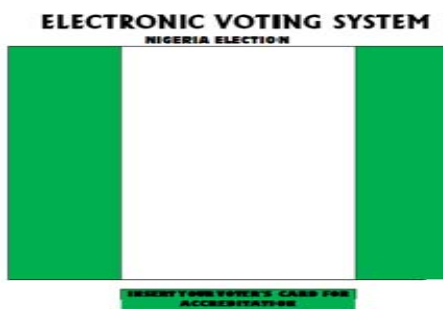
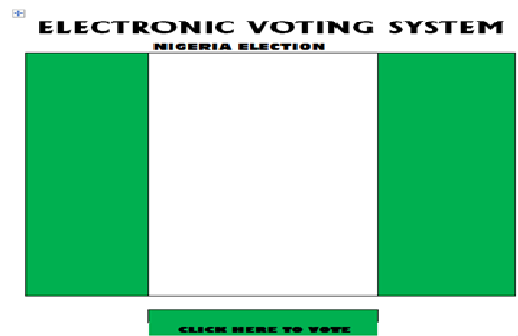## Appendix 1… interface



Figure 4: Interface for Accreditation of Voter
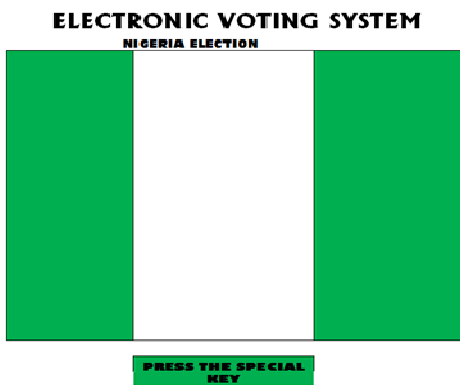


5: Interface to Begin Voting Proper



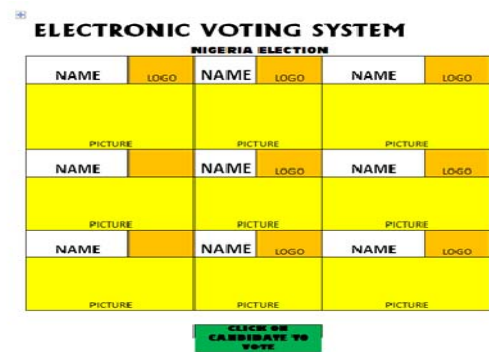Figure 6: Interface to Select Category of Vote



Figure 7: Interface to Cast your Vote

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