The Effect of E-Voting and the Alternative Ballot Box In Nigeria

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ABSTRACT: *The inefficiency of manual voting system, the time and resources wasted during voting period brought about loss of trust in Nigeria's democracy system. This paper looks into the effectiveness of the Electronic Voting System (EVS) with an alternative Electronic Ballot Box (EBB) in Nigeria's democracy. The EBB is designed with an aluminium frame to make it light weight and a transparent plastic body to clear visibility of contents in the box while the EVS is designed to allow voters register online and cast their votes online or using EBB. With EBB papers are dropped into the box via the paper feeder top and pass through the scanning unit before it drops into the box. It thus provides accuracy, speed and security that would ensure credible election at any level of government. This design reduces the risk of widespread fraud manipulation at polling station level and beneficial in an environment where there is little or no public confidence in the polling officials.*

Keywords: EVS, EBB, Accuracy, Speed, Security, Environment.

I.   INTRODUCTION

Electronic voting is often seen as a tool for advancing democracy, building trust in electoral management, adding credibility to election results and increasing the overall efficiency of the electoral process. The technology is evolving fast and election managers, observers, international organisations, vendors and standardisation bodies are continuously updating their methodologies and approaches.

Voting technology and ballot design can influence election outcomes, and affect how voters felt about their ability to exercise their right to vote and influence voter's willingness to accept the results of an election as legitimate (2).

Democracy thus encourages individual freedom according to the rule of law, so that people may behave and express themselves as they choose. This not only gives people a chance to choose their leaders, but also to freely express their views on issues. Voting is a method by which groups of people make decisions. These decisions could be political, social or public. Voting can also be used to choose between difficult plans of actions or to decide who is best eligible to be awarded a prize. Voting can thus be defined as a process that allows a group of individuals to

choose between a number of options. (1). While (7) in his submission said that electronic voting security criteria, i.e., confidentiality, integrity, availability, reliability and assurance, can be concluded that a lot of such criteria are by nature very difficult to satisfy. Therefore, Despite all the success stories recorded on the use of electronic voting systems, it is believed that further studies must be carried out to improve upon them (6).

But in Nigeria, the electoral body-Independent Electoral Commission (INEC) conducted the elections using manual method and the elections were marred with so many irregularities. Due to irregular and ineffective power supply, total reliance on on-line voting may be difficult thereby bringing to fore the combination of both the on-line and the electronic ballot box method of voting. Unlike just every other system in our society, this voting system must be usable by every citizen at least 18 years old. This includes the elderly, disable, uneducated and poor users. Validation is carried out using any government approved means of identification like Driver's Licence, National Identity Card, and International Passport or electronic means like biometric capture. (1).

1.1 RELATED WORKS

There are quite a number of few literatures relating to electronic voting system and alternative ballot box. The framework for Online Voting System (OVIS) where a platform for simulating the electoral process for all Institutions that employ voting in decision making was proposed by (1). OVIS has several security requirements like access control and user authentication, making it not only secure and reliable but also resilient.

In their work (8) proposed a 3-tier Enterprise Application Architecture with the introduction of the SOA services layer to the business tier. While (3) proposed a robust multilayer (Steganography and Cryptography) data security, multi-domain (Image, video and/or audio) model. This architecture is client-server architecture based on three-tier architecture. Whereas in (11), efforts were directed towards developing application for voting using Biometric Data to eliminate election irregularities. In this work, voting application was designed to allow Nigerians in Diaspora to participate and vote in all national elections from outside the country. They then developed a software taking into consideration security lapses and threat observed in several recent studies in electronic voting. Whilst in the work of (9) an enhanced secure E-voting model was proposed. Here, in their technique, they modified least significant bit (LSB) which consists of two parts namely the embedding and the extraction part. The developed algorithm takes the LSB of the cover medium (Spartial Image) and swaps them with a sequence of bytes containing binary equivalent of voters confidential information (Electronic ballot). Whereas in the work of (10) they proposes a secured electronic Voting system. Their work was designed using Software Development Design (Programming Interface). This involves the design and implementation of an Online Voting Portal that could be used for e-voting. This portal was designed using ASP.NET MVC which is an open source web application framework that implements the model–view–controller (MVC) pattern. The online portal had its design using the Microsoft Visual Basic Environment (MVBE) with the ASP.NET Model-View-Controller (MVC) which is an open source web application framework that implements based on the MVC pattern.

But in this work, the design using software development and an alternative ballot box was proposed. This involves the design and implementation of an online portal using the ASP.NET MVC as shown in figure2.2 and the design of an emulator circuit embedded in the ballot box.

II.   METHODOLOGY

The method employed in this project is the automated voting system which comprises of an Online Portal for e-voting and an Electronic Ballot Box (EBB) also known as alternative ballot box, construction for the conventional polling station voting. The inefficiency of manual voting system and time, resources wasted during the voting has brought about the development of an EBB that uses an automated voting system which would provide accuracy, speed and security that would ensure a credible election at any level of government.

2.1 DESIGN ANALYSIS AND IMPLEMENTATION

This project was designed in two phases, which are the:
- ❖ Software Development Design (Programming Interface). This involves the design and implementation of an Online Voting Portal that could be used for e-voting. This portal was designed using ASP.NET MVC which is an open source web application framework that implements the model–view–controller (MVC) pattern.
- ❖ Hardware Development Design. This involves the construction of an Alternate EBB and a counter circuit with a PC Configuration which interconnects the software and hardware development.
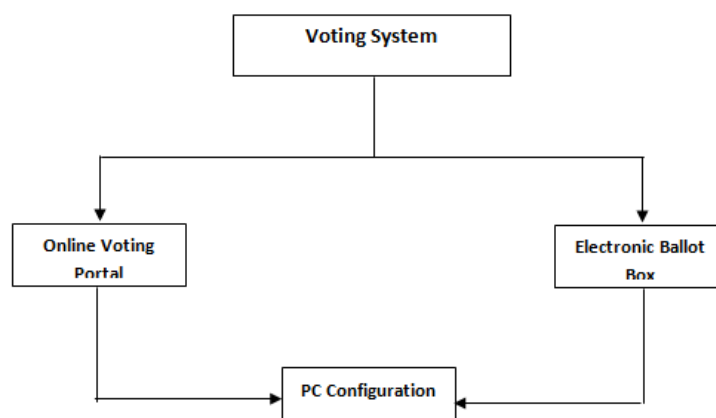

Fig 2.1: The Design Analysis

The online portal had its design using the Microsoft Visual Basic Environment (MVBE) with the ASP.NET Model-View-Controller (MVC) which is an open source web application framework that implements based on the MVC pattern. A *model* represents the state of a particular aspect of the application while a *controller* handles interactions and updates the model to reflect a change in state of the application, and then passes information to the view. A *view* accepts necessary information from the controller and renders a user interface to display that information. The figure below explains the roles of the voter and administrator software. The voter software refers to the section of the portal that handles voters' information while the administrator software refers to the section of the portal that is open and assessable to the portal administrator in other to supply voter information.
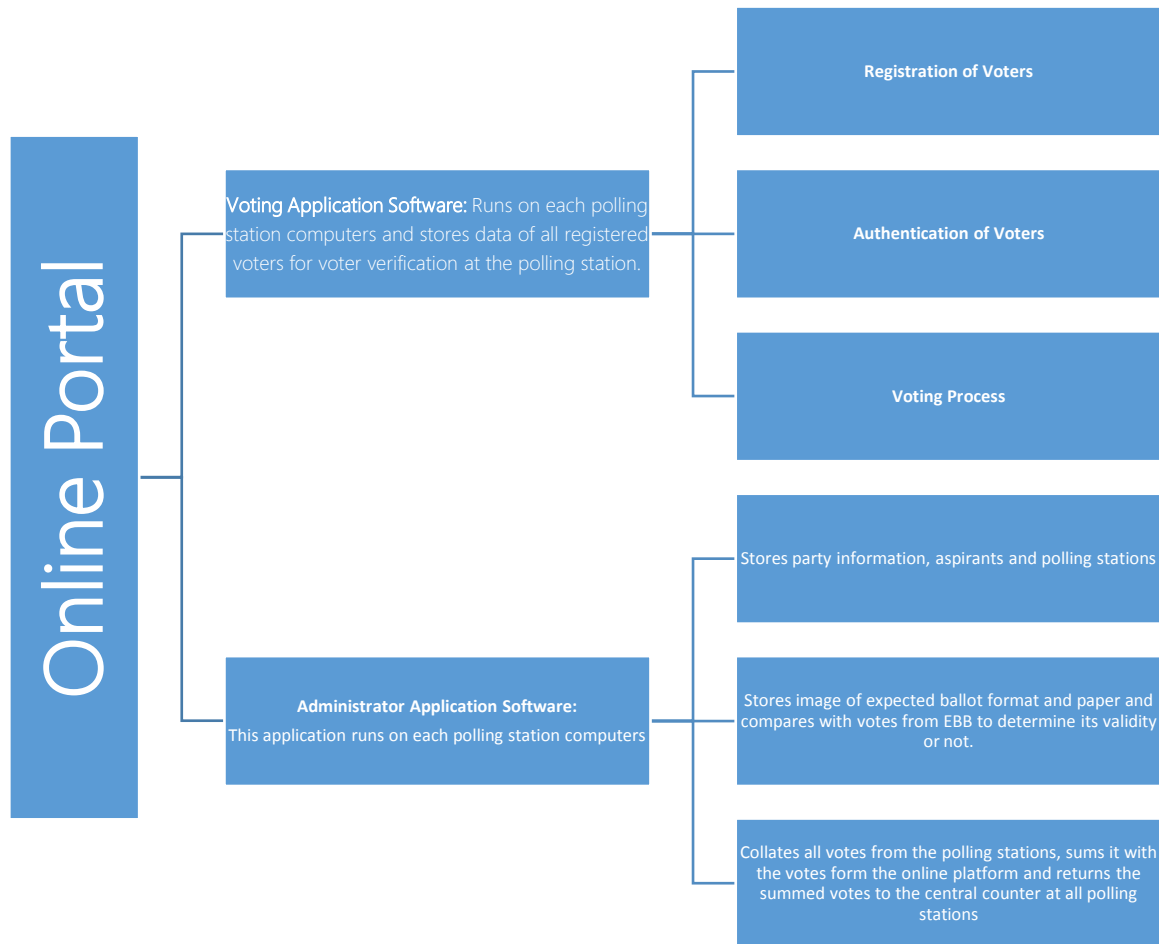

Registration of Voters

Authentication of Voters

Voting Process

Online Portal

Voting Application Software: Runs on each polling station computers and stores data of all registered voters for voter verification at the polling station.

Administrator Application Software:
This application runs on each polling station computers

Stores party information, aspirants and polling stations

Stores image of expected ballot format and paper and compares with votes from EBB to determine its validity or not.

Collates all votes from the polling stations, sums it with the votes form the online platform and returns the summed votes to the central counter at all polling stations

Fig 2.2: Online Voting Chart.

The chart in figure 2.2 depicts the application embedded in the voting portal developed. The embedded applications comprises of; The Voting Application Software that incorporates the voter registration, voter authentication and the voting process as well as the Administrator Application Software that incorporates the party information, the expected format and ballot, the ballot comparator and the collation of votes from the polling station and online votes and summation of same. The voting process is as depicted in fig 2.3. The flowchart represents voting process via the online portal and the EBB. The path labelled 'YES' in the flowchart represents the Online Voting while the path labelled 'NO' represents the EBB voting. Voting commences on the online platform with a successful completion of voter authentication process. Upon login, an online ballot paper will be generated. The ballot paper carries the party logo and the position(s) vied for and the voter is expected to select the party to be voted for. The voter confirms the ballot paper and proceeds to vote by clicking the vote tab. This stage generates another token that will authenticate the vote. This token would be forwarded to the voter's mobile phone via a Short Message Service (SMS) and the token would be valid for 5 minutes after which the token becomes invalid. The token received is typed into the portal to validate the vote, however, if the token had expired the cast vote would be recorded as invalid. The online counter displays the number of valid

and invalid votes. Non-online voters commences their voting process by taking the printed card to the polling station when the card would be scanned with a bar code scanner. This is expected to display voter stored data uploaded during registration. Upon successful display of voter information and verification of voter, the voter is issued a ballot paper and the voter goes through voting pre-determined process. The EBB has counters attached to it that displays the valid and invalid votes. The online portal and EBB is linked with a summation counter that sums the vote cast with the two platform
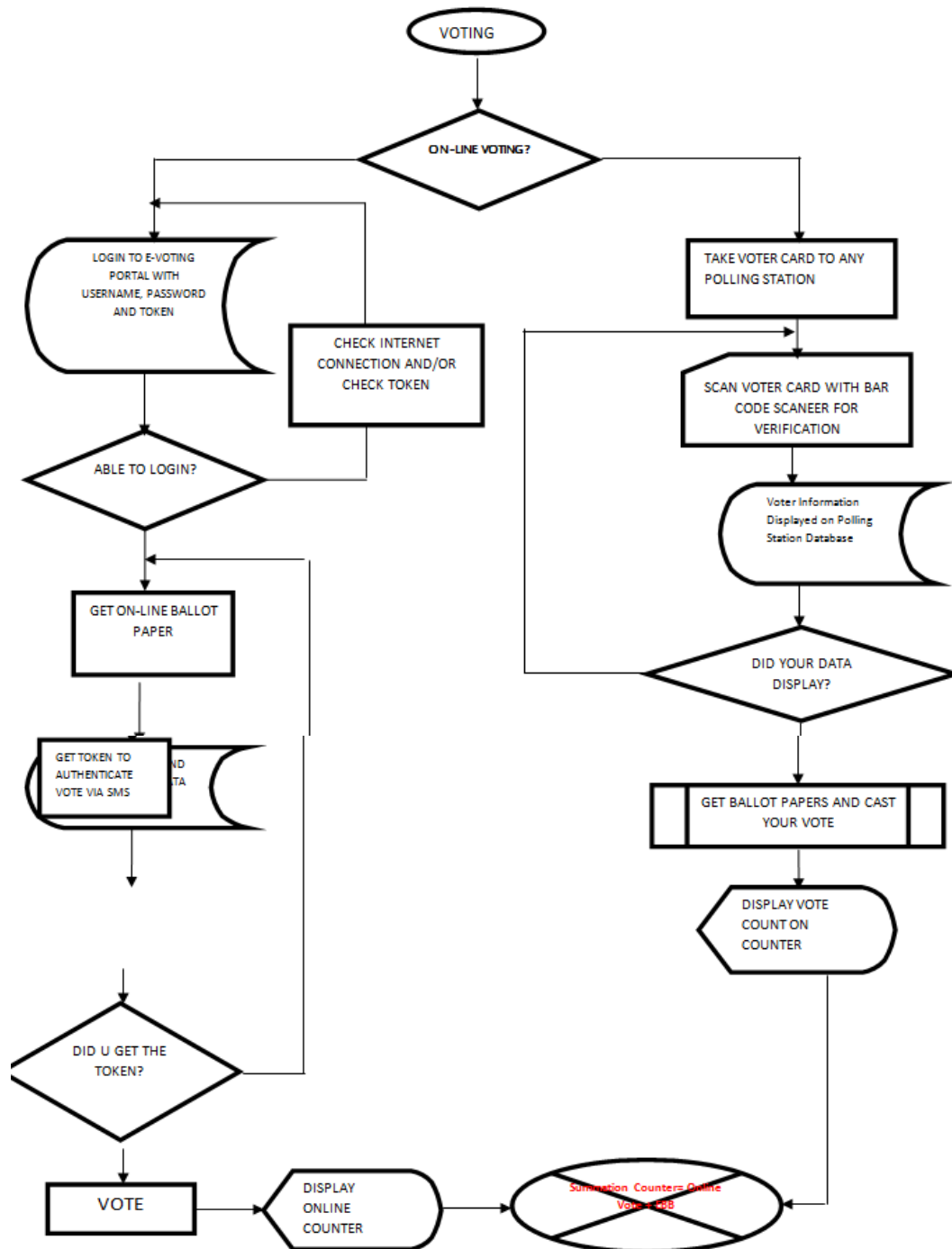
Fig 2.3: Voting Process

2.1.1 The Administrator Application Software

The Administrator manages and controls all the activities of the portal, and also setup the portal for use by the voters. Hence, the administrative software performs the following functions;

- All information about political parties are stored under the administrative software. The party information includes, the logo and positions the party would be vying for. The ballot paper that carries all party logos and position vied for will be stored under the party information platform.
- Images of the ballot paper and the approved format of ballot (either thumb print or mark print) that will be used to compare votes that are cast with the EBB to determine its validity will be stored under the administrative software. Hence, votes that meets the stored format would be returned as valid, otherwise it would be returned as invalid.
- All votes cast online and at the polling station with the EBB are collated under the administrative software. For the collation to occur, votes from the polling stations are pushed to the central server via the internet from where it is summed with the votes cast online. The summed voted are then pushed back to individual polling station computer via the internet from where it is displayed on the central counter (not counter attached to the EBB) connected to the polling station computer via Bluetooth connection.

2.1.2   Electronic Ballot Box (EBB)

The EBB shown in figure 2.4 is an electronic voting box used for vote cast, count, collation and display of vote result during and after the election process. The box is design with an aluminium frame to make it light weight and a transparent plastic body for clear visibility of contents in the box. Ballot papers are dropped into the box via the paper feeder on top of the box and the paper passes through the scanning unit before it drops in the box. As the paper passes through the scanner a photo sensing unit in the scanner captures the images on the paper and the image of the thumb print which indicates the vote. These images are compared with the pre-installed images on polling station computer to determine the vote validity. If the images tallies with what is captured a valid vote count is return to the EBB and displays the count under the valid 7-segment counter on the EBB, otherwise, an invalid vote count is returned and displayed under the invalid 7-segment counter display.

Fig 2.4: The Ballot Box

The main parts of the ballot box are the scanning unit and the counter.

2.1.2.1   The Scanning Unit

The scanning element shown in figure 2.5 was added to the fabricated ballot box to scan the ballot paper. The Scanner used is an unattended Automatic Document Feeder (ADF) scanner that allows document to be stacked into the document feeder and the scanner starts to scan in the document with minimal attention. The scanner begins its operation by first initializing the head when powered on. The scanner head is move by a rotor place at the right side of the scanner, when the head moves it touches a sensor that senses the head and returns the head to the home location (starting point) this operation completes the scanning process. However for use in the project the scanner is not required to run on ADF, and since the scanner unit, which comprises of the scanner head and the scanner lighting unit have been detached for use in the EBB construction, the initialization process of the scanner will no longer work adequately, hence, an Emulator Circuit shown in figure 2.8 was designed to emulate the scanning and working operation of the scanning unit and to synchronize with online voting system and the counter.

Fig 2.5: Scanning Unit

2.1.2.2 The Counters

The EBB consists of two counter working simultaneously to show the vote count at the polling station and a collation of vote cast online and with the EBB. Both counters uses are 7-segment display counter circuit to display its count. The counter circuit are controller with the UDN2918A controller shown in figure 2.6. The emulation circuit discussed in section 2.1.2.3 connects the counters together with other parts of the scanning head.
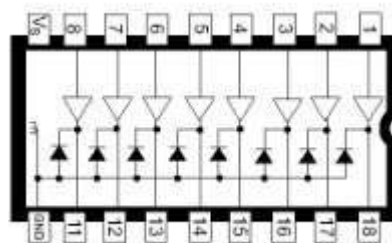

Fig 2.6: UDN2981A Controller

2.1.2.3 EMULATOR CIRCUIT

The Emulator circuit shown in figure 2.8 was designed to compensate for the initialization process of the scanner that was distorted when the scanning unit was removed from the scanner and to build a communication between the scanning unit and the counters (EBB Counter and external counter).). The composite unit of the emulator circuit are;

a. The head initialization circuit (Purple Colour marked 1): This circuit comprises of three (3) transistors that are used as Opto-isolators to monitor the signal coming from the scanner motor and back into the scanner. The first two transistors (circuit in rose colour marked 1a) monitors the signal coming from the scanner motor to ensure it generates the appropriate signal while the last transistor (Gold Colour marked 1b) is used as a controller to generate signal back to scanner.

b. The PIC 16F877A Controller (Brown colour marked 2): This controller is a microchip shown in figure 2.9 that keeps the emulator codes which controls all the functions of the head initialization process, and it also connects to counter circuit and the Bluetooth interface.
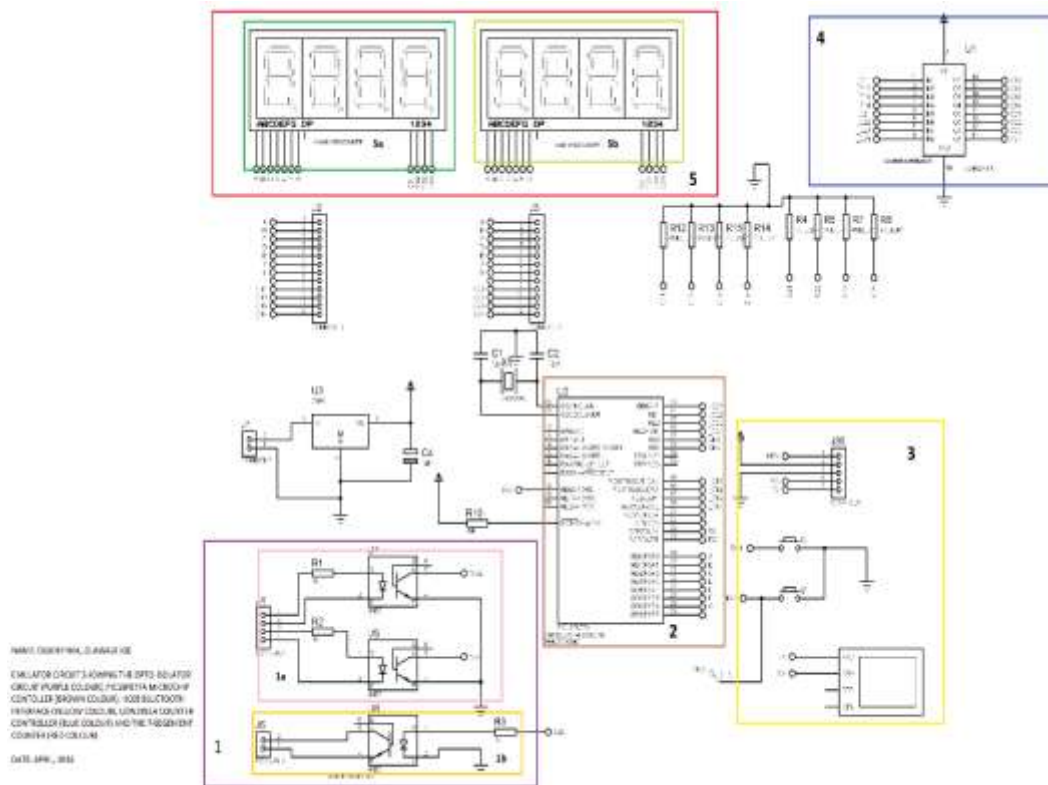
Fig 2.8: The Emulator Circuit.

Fig 2.9: PIC16F877A Microchip

To display the total number of vote for each political parties as the election progresses there is an external counter connected to the polling station computer via a HC05 Bluetooth (Yellow Colour marked 3). To transfer the cast vote on the EBB to the central polling server the internet access is used, for where it is summed with the online votes. The summed votes are returned to the polling station computer via the internet form were it is displayed on the central polling station counter connected to the polling station computer via the HC05 Bluetooth. The counter display are synchronized with the online voting result ever 10minutes and the displayed results are charged after the synchronization process (that is the summation of both the online and ballot box result).

2.1.3.   Database

Database management is an integral part of this project judging from the quantum of information that needs to be save, retrieved and transferred during and after the election process. To manage the database the Structured Query Language (SQL) was incorporate into the Visual Basic Environment to manage the data. **SQL** (**Structured Query Language**) is a special-purpose programming language designed for managing data held in a relational database management system (RDBMS), or for stream processing in a Relational Data Stream Management System (RDSMS).

III.   TESTING AND RESULT

3.1 ELECTRONIC VOTING SYSTEM

After completion of the portal design and coding, the portal codes were debugged and run on the Mozilla Firefox browser and the Home Screen is as shown below,

Fig 3.0: Electronic Voting System Home Screen

Once registration is completed with age validation, a voter card is issued, the voter card is issued with a bar code which is necessary for verification if the voter would be voting with the EBB.
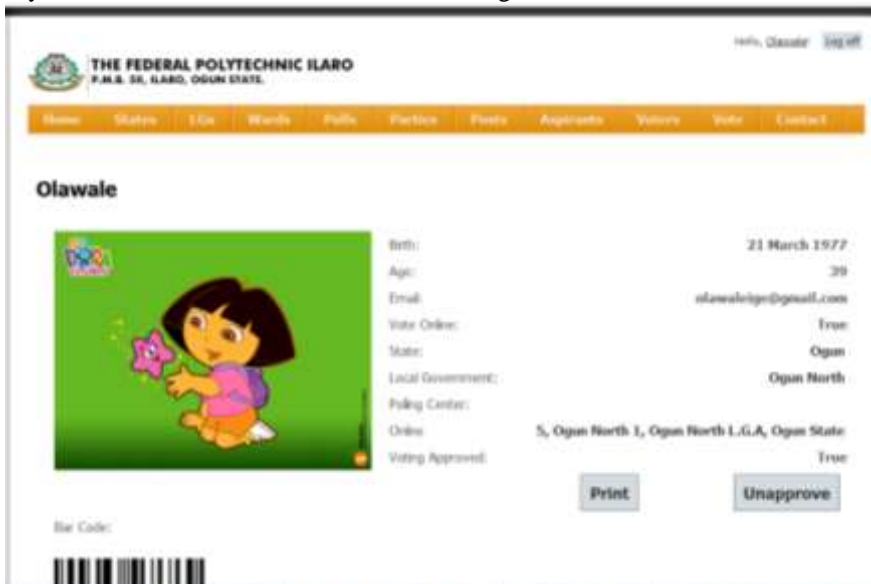

Fig 3.1: Voters' Card

- Voter Authentication: Once voting commences every registered voter is expected to log into the voting paltform with the username, password and token issue during registration.

3.2 PC Configuration

The PC is configured to establish a link between the EBB, the online platform and the counter. This is necessary because from time to time the EBB will have to send the vote cast to the Online Platform for comparison and the Online Platform needs to return the verdict of the comparism to the EBB to determine its validity or not. In the same vein, the online platform needs to return the counter of every ballot dropped into the EBB to the counter on the EBB and also the total ballot cast to the central counter. Hence, to achieve this the ballot and the counter

needs to be configured on commnication ports on the PC and for the project Com Port 5 and 7 were confirgured for the Ballot Port and Counter Port respectively as shown in fig 3.2 below.

Fig 3.2: Port Configuration on the Poll Amin.

3.3　Electronic Ballot Box (EBB)
The EBB as discussed in the methodology is an electronic box that will not work in isolation, hence, it needs to communicate with the online platform at all times for its efficient performance. In the light of this the following information will be provided on the polling station PC for effiecient performance
 i. Data base of all eligible voters to ensure proper verification of voters using the EBB.
 ii. Bar code scanners to scan the voter card presented at the polling station.
 iii. Internet accss to communicate with the online platform
 iv. Central counter connected to the PC via the HC05 Bluetooth to display the overall results from the online platform.

IV.　CONCLUSION
The democracy upon which our modern society is built ultimately depends on a system that collects and counts votes. Thus, from the top right corner of the home page every eligible voter that logs on the voting portal is expected to register at the commencement of the registration process. Once the register button is clicked the registration page is displayed. Once registration is completed with age validation, a voter card is issued, the voter card is issued with a bar code which is necessary for verification if the voter would be voting with the EBB. There is synergy between the online voting process and the EBB in terms of vote counting therefore making the whole process very easy and stress free.

ACKNOLEDGEMENT

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