Design and Implementation of E-Voting System for Student Union Election in Emmanuel Alayande College of Education, Oyo

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ABSTRACT

Virtually in all Nigerian tertiary institutions manual voting systems were used for the conduct of students' union elections and this system is primarily characterized by high incidences of violence, delay of results, electoral malpractices and irregularities. Preventing mistrust-induced election violence requires the deployment of a trustworthy alternative to the paper ballot system. In this study, an electronic voting system (EVS) is developed using Visual Basic and Microsoft Access Database for the conduct of student union election in Emmanuel Alayande College of Education, Oyo. The application performs voter authentication by verifying a pre-issued pin (voter's ID) which is unique for each voter. The system is accurate, efficient and reliable thereby building trust in the process. For the effective implementation of the EVS, students should be well trained on how to effectively use the system. Management should put in place adequate facilities to effectively implement the EVS and proper maintenance routine for smooth running of the system.

Keywords: Electronic Voting System, Emmanuel Alayande College of Education, Microsoft Access Database, Student Union Election, Voter's ID

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1. INTRODUCTION

Student Union Government (SUG) is a central part of administration in higher institution of learning which serves as intermediate between the students and the Management of the institutions in the affairs of administration and supervision of the institution. The SUG serves as a platform for the student community to express views, communicate desires and concerns to the university management, and also pursue common goals on a unitary platform (Peter and Ebimobowei, 2015). The SUG prevents oppression of the student community by the Management of the institution, and also articulates their views in cases of corruption and mismanagement of resources by the institution's management (Adekitan, Matthews, John and Uzairue, 2018).

Student Union Election process in the years back and nowadays was characterized with numerous challenges such as rigging, vote buying, deny to vote, delayed results, intimidation, disfranchise, violence, etc. As a result of these challenges, many students did not trust the results of the students' union elections while some even refuse to participate in student union elections again and the voting ratio is now reducing drastically. Presently, students' union elections at Emmanuel Alayande College of Education, Oyo were based on paper ballots (Manual Secret-Ballot Voting System) at six different locations within the campuses where there is control over who should vote. This voting system is both inconvenient and susceptible to error.

Voting is core to democratic processes and the mode of voting must be credible and trusted by all stakeholders (Nogueira and Sa-Soares, 2012). A good voting system must be tamper proof and also assure the anonymity of the voters for their protection and safety (Suwandi, Nasution and Azmi, 2018). In this era of rapid globalization, the impact of information and communications technology (ICT) advancement is becoming more prominent in Nigerian institutions (Molokwu and Agu, 2014). Therefore, there is the need for the automation of the students' union election. An electronic voting system is a paperless form of voting system whereby voter's authentication, casting of vote, votes counting and declaration of the election results were done through the use of ICT in order to prevent any forms of fraudulent acts and to build trust in the election process. It involves meeting an electorate to make a decision or express an opinion, usually following discussions, debates or election campaigns (Bellis, 2007).

E-voting systems can be on or off the internet. Internet based system creates opportunities for remote voting centres which increases accessibility and reduces queues at voting centres. However, it may be susceptible to identity fraud, hacking attacks and election result manipulation (Habibu, Sharif and Nicholas, 2017). Regardless of the benefits of E-voting, the variety of its use globally is still, though, partial as it has a shortcoming on many stages such as lawmaking, societal, partisan and technical levels (Watt, 2002; Mitrou, Gritzalis, Katsikas and Quirchmayr, 2003; Riera and Brown, 2003).

2. RELATED STUDIES

Adekitan, Matthews, John and Uzairue (2018) developed an E-voting system for student union government elections using Microsoft Visual Basic in Visual Studio 2010 environment. The database on which the VB 2010 application runs was deployed using database programming with SQL Server and ADO. This system has three classes of users and access rights (i.e. Administrators with full access to the database for adding voters and creating profiles for other system users, Agents-these are witnesses and appointed representatives of the contestants for the various SUG offices and Voters-these are students of the institution that has been registered and approved to participate in the election).

The application is installed on computers at the voting centre with adequate arrangement to ensure secret ballot and to prevent online hacking via the Internet. Nzoka, Muthana and Mung'ithya (2013) developed Taita Taveta University College e-voting system using a web approach to elections management. This system is in form of a portal that is embedded on the Universities website. The system was developed using the incremental prototyping due to the adaptive nature of web based applications. The system was implemented using PHP and MySQL server technologies. The client side was done in DHTML set of technologies. The system proved that a computerized solution is possible with elimination of human related faults that are a commonplace in employment of human clerks to manage the election process.

Hosany and Chedembrun (2017) developed student online voting system which is an android base application used by the students of University of Mauritius during the student union election. The UoM Online student Voting System" will act as a client/server application. It will describe how a user can vote using an application installed on his Smartphone. This system comprises of a Mobile Client Application, Server Application, Web administration panel and a central database. The programming for this application is based on the traditional client/server model. The user is presented with a screen where he/she can choose the desired candidates. Once the user has voted, the data is transferred to the server application, which then performs validation and updates the database if successful. The system enables voters to poll their vote from anywhere but voters should provide their student ID and password to authenticate themselves. This constraint is imposed to ensure that only the students studying at UoM are allowed to vote in the election. The system was built using android development tools –Eclipse IDE with Android Software

Development Kit (SDK), WAMP Server and MySQLdatabase. Habibu, Sherif and Nicholas (2017) developed an electronic voting system for Muni University Student's electoral body using PHP and MYSQL.
MYSQL server was used to implement the back-end of the system. The access to the database server was made possible by a graphical interface (PLPMyadmin). Lastly, Molokwu and Agu (2014) proposed a secure intranet voting system for students' union election in Nigerian tertiary institutions.
The front end of the system will be implemented using HTML 4.0+, CSS 2.0+, JQuery 1.8+, Javascript 1.5+ and Adobe Photoshop 7.0+ while MYSQL 5.0+, PHP 5.0+ and RSS 2.0+ will be used to implement the back-end.

3. RESEARCH OBJECTIVES

This study designed an E-voting system for students' union elections at Emmanuel Alayande College of Education (EACOED), Oyo. The following are the primary objectives of this research project:

1. To investigate user requirements for an e-voting system.
2. To provide an electronic system through which students of Emmanuel Alayande College of Education, Oyo can cast their votes offline.
3. To provide a system that automatically tallies cast votes for individual candidates
4. To provide a system that will relay the results of election on time.
5. To provide management and administration of Emmanuel Alayande College of Education, Oyo an easy way to manage and monitor the entire election process from a computer based interface.

4. STATEMENT OF THE PROBLEM

The college has an overall enrolment of up to 4000 students belonging to six different schools. Student Union elections within the college had been faced with many challenges such as delayed results, fraud, violence, intimidation, overworked officials and the undeniable aspect of human error. The existing system of voting in the students' union elections is time consuming, fraudulent, costly and inconsistent. In the light of the afore-stated challenges, it was deemed necessary to come up with a system that addresses the challenges and ensures that students vote at their comfort without intimidation, there is prompt release of elections results, election cost is moderate and credible tallying and tabulation of votes are provided.

5. ANALYSIS OF THE PRESENT VOTING SYSTEM AT EMMANUEL ALAYANDE COLLEGE OF EDUCATION, OYO

At EACOED, election takes place every year. Emmanuel Alayande College of Education, Oyo comprises six schools (i.e. School of Arts & Social Sciences, School of Early Childhood Care and Primary Education, School of Education, School of Languages, School of Science and School of Vocational & Technical Education.). The students' union election comprises Central Executive Council (CEC), Students Representative Council (SRC) and Student Judiciary Council (SJC). The CEC post consists of President, Vice President, Secretary, Assistance Secretary, Treasurer, Financial Secretary, Auditor I & Auditor II, Social Director, Sports Director, etc.). This electoral procedure involves many processes. The processes involved are listing of all eligible students, voting, vote counting, collation and publication of results.

The students' matriculating list generated by the Admission Office was used as a voter register and only the students whose his/her name appeared on this list are eligible voter that will be allowed to vote after checking his/her student identity card. The Voting is the actual process of casting ballots. An eligible voter goes to the polling station where his name is registered and uses his student ID card to vote.

Firstly, he is issued a ballot paper to cast his vote, then move to an enclosed space to select a candidate of his/her choice on the given ballot paper and tick in a space allotted for that candidate. The voter then carefully folds the ballot paper and deposits it into the ballot box provided. He is then expected to leave the polling centre. The processes of Vote counting and publication of results consist of Ballot counting which is done manually and after that the result is published. The present system of voting whereby the voters go to the voting venue to perform their duty and the results are counted and given to students undoubtedly conveys numerous drawbacks given below and which need to be taken into consideration (Hosany and Chedembrun, 2017):

1. **Counting process is slow:** There are about 4000 students at EACOED and assuming that three-quarter of the college population voted gives rise to a large amount of ballot papers. And counting all of them is a very time consuming process.
2. **Errors during the counting process:** It is possible that the counting process contains errors because humans are subjected to errors.
3. **Absenteeism:** The current voting system requires the voters to vote only in polling centres. Statistics show that the main reason for absenteeism is that students do not have lectures on Election Day (therefore they feel no need to come to the college especially to vote) or some do not want to wait for long time in the queues at the polls.
4. **High cost:** This type of voting is very expensive as both human and financial resources are involved. Dean Students' Affairs and some staffs are assigned to look after the smooth running of the election and it is costly to print ballot papers and counting sheets.

6. MATERIALS AND METHODS

Newly Designed System

The Electronic Voting System (EVS) was developed using Microsoft Visual Basic in Visual Basic 6.0 IDE environment. The database on which the VB 2010 application runs was deployed using database programming with ADO.NET. A Microsoft Access Database file is a relational database system that enables the linking of tables for improved database performance.

In a voting system, voter identification and authentication is very vital (John, Ayo, Ndujuiba and Okereke, 2013; Kabandana and Kumar, 2016), this can be achieved by using a smart card (Ya'acob, Azize, Yusof, Samin, Naim and Rohaizad, 2018), an online signature (Daramola, Adefuminiyi and John, 2016), a unique login details, pin and so forth. In the EVS developed, student data such as their complete names, matriculation number, School, Department, academic level and course combination are obtained directly from the college MIS/ICT Centre. Using the Matric number of each student, a unique access pin is generated for each student (i.e the Voters' ID). The pin is generated and given to the students (during accreditation) on the day of the election to prevent any form of manipulation and fraud. Accreditation is done alongside the Voting process. Once a student is accredited he/she moveS to the available system to cast his/her vote with his/her Matric number and Voters' ID, which serves as Username and Password respectively. The EVS has two classes of users and access rights as detailed in Figure 1.

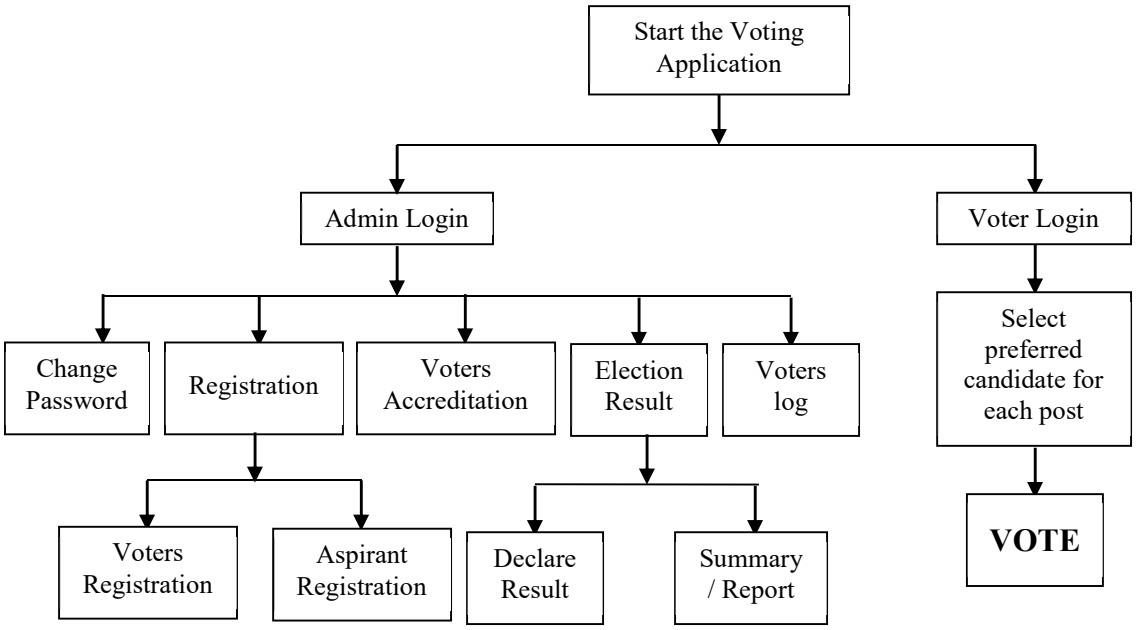

Figure 1: The access right of each class of EVS user

1. **Administrator:** They have full access to the database for adding voters and creating profiles for Aspirants as shown in Figures 6 and 7. The administrator login using the form shown in Figure 3 and manages the application as shown in Figure 4. The form for changing admin password is shown in Figure 5.
2. **Voters**: These are students of the institution that have been registered and approved to participate in the election.

The application is installed on computers at the voting centre with adequate arrangement to ensure secret ballot. Prior to the commencement of voting, the electoral chairman will login to confirm that the voting result for all the candidates is zero. This will be projected on the projection screen for all agents representing candidates for each post to see. Registered student voters will fill their details into the voter's login page and also enter the voters' ID given to them, and then click login. The system authenticates the data entered in Figure 6, and if confirm accurate, a message box is displayed showing the name and level of the student. The student must confirm his or her identity by clicking yes, in order to access the SUG candidates form for voting. If authentication fails the user is denied access and a warning message is displayed.

To vote, the voter will select the corresponding post and checkbox for their preferred candidate and click on each post in the position panel to display respective candidates contesting for the selected position as shown in Figures 10 and 11. On clicking **VOTE**, a VOTE confirmation dialog box is displayed, requesting the voter to confirm the desire to vote for the selected candidates. When the voter clicks VOTE, the database is updated for the selected candidates, another form is displayed for the voters to cast both the Representative and Judiciary arms election, the application will display all respective candidates for both representative and judiciary arm, in accordance to the voters school, the voters were to select at most 10 and 2 most preferred candidate of their choice for both school representative and judiciary respectively and then click **VOTE,** and a form greeting the voters for taking their time to vote will be displayed and the application returns to the login page.

The details of the voter, the voters ID used to vote and the time of voting is updated in a database table called “log” This is to allow the system to check those who have voted. Also, the application is developed to prevent an attempt by the voters (i.e students) to vote twice so as to prevent double voting. If such attempt is made, the application responds with a dialog box “Sorry, You cannot vote twice”.

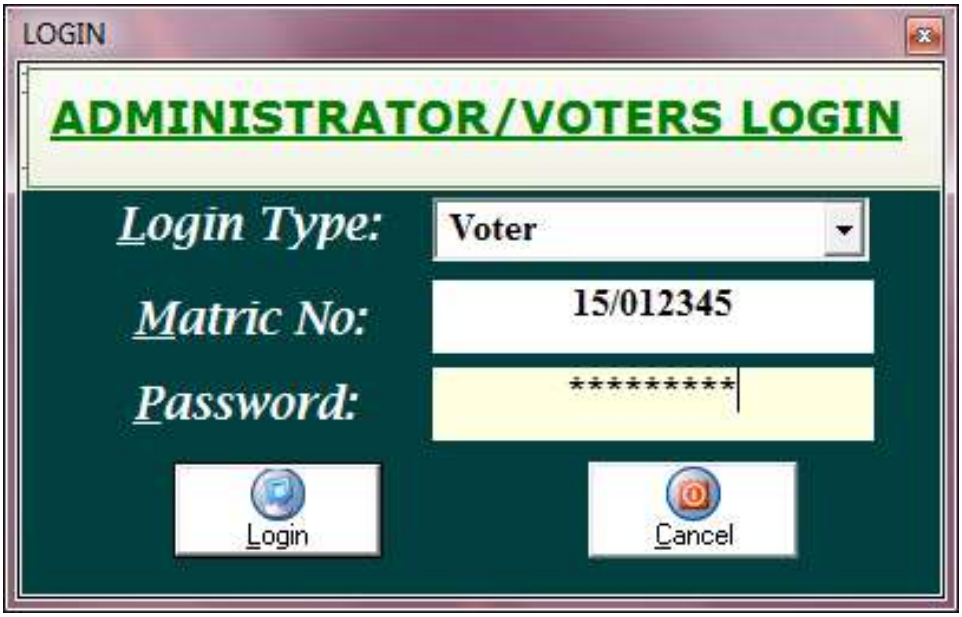

Figure 2: Voters Login form

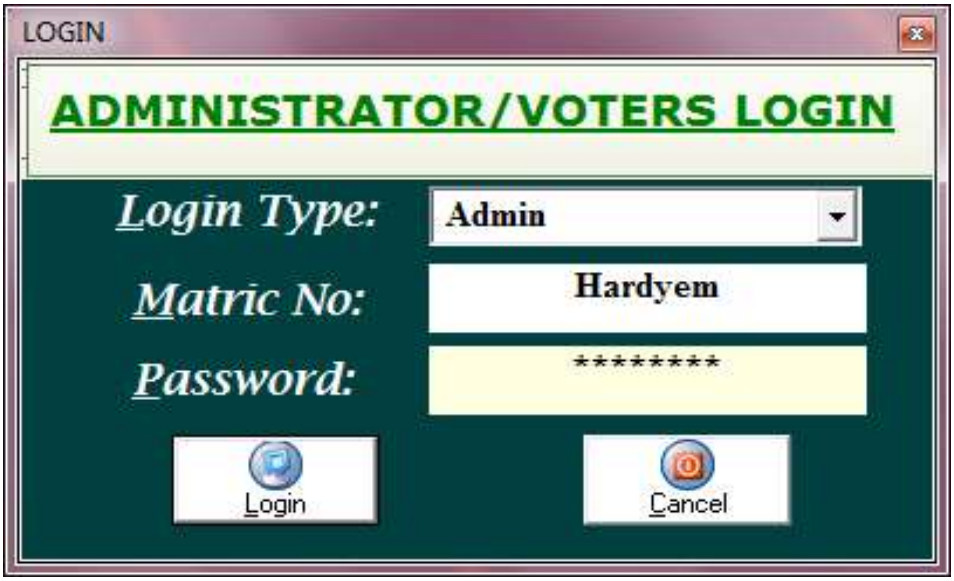

Figure 3: Admin Login form

Figure 4: Admin Menu form

Figure 5: Changing Admin Password form

Figure 6: Voters Registration form

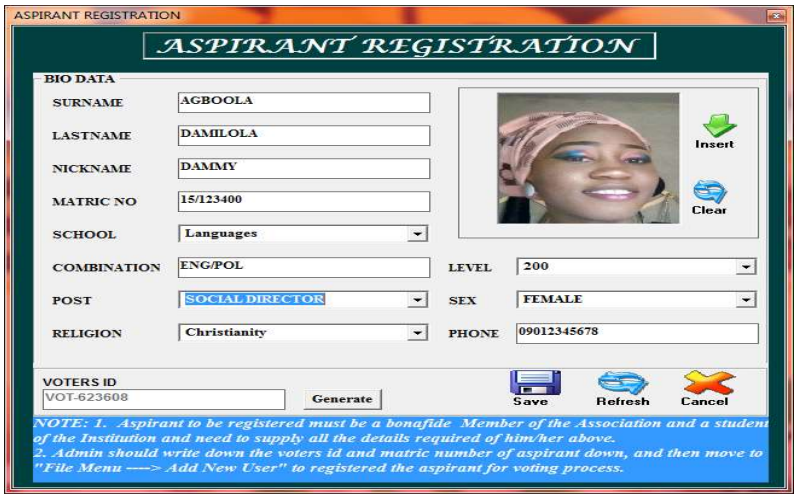

Figure 7: Aspirant Registration form

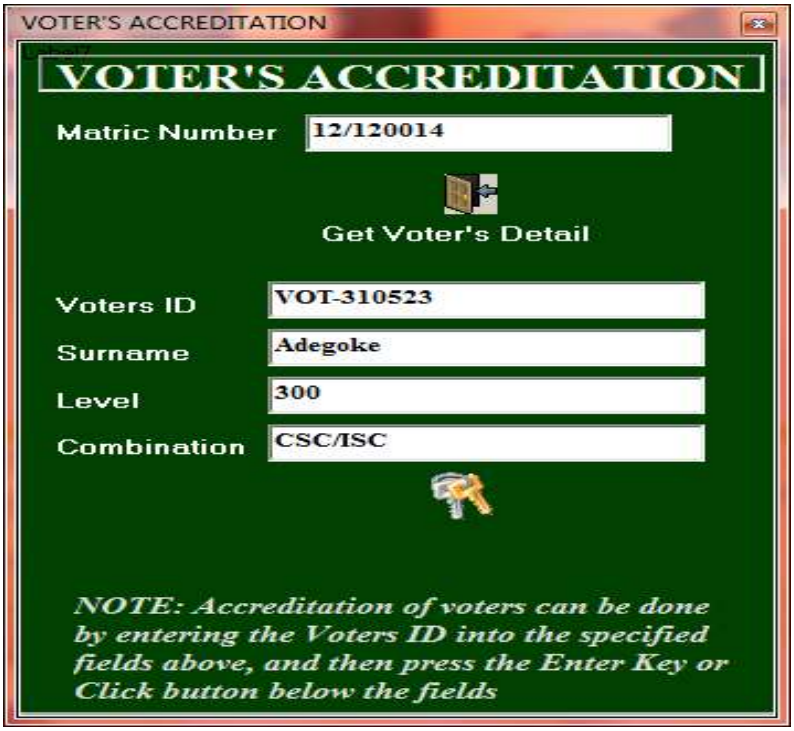

Figure 8: Voters Accreditation form

Figure 9: Voters' Log records form

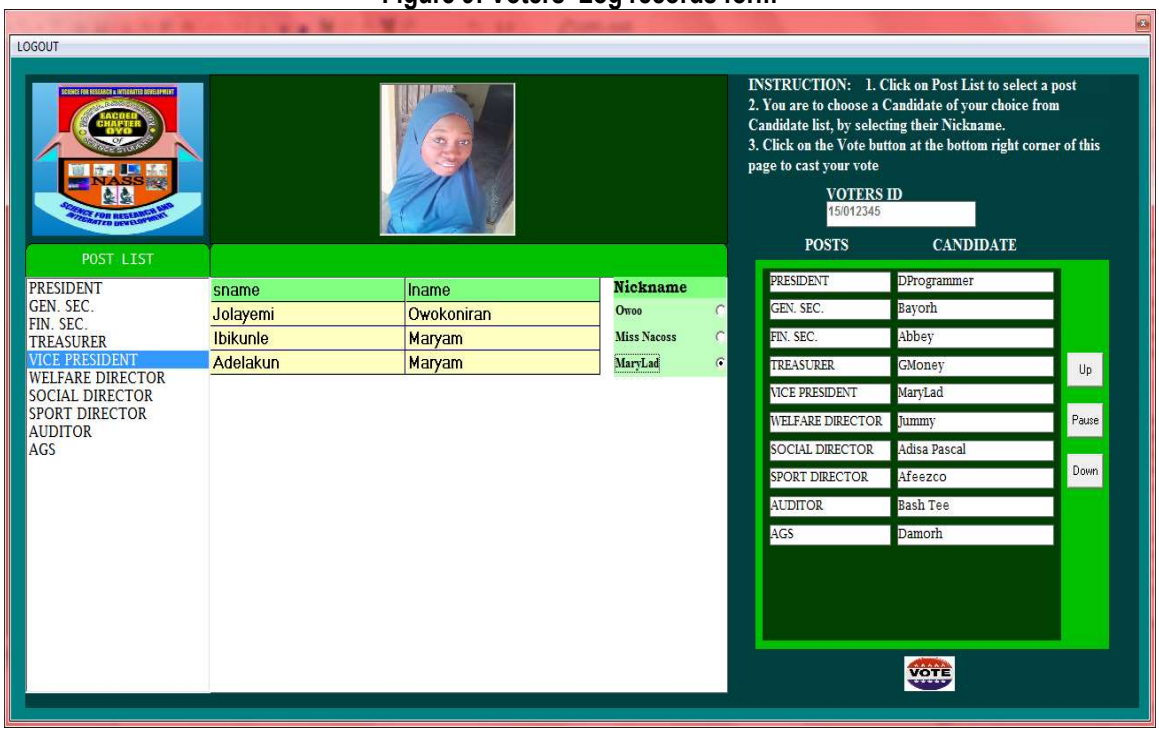

Figure 10: Central Executive Council (CEC) Candidate Voting form

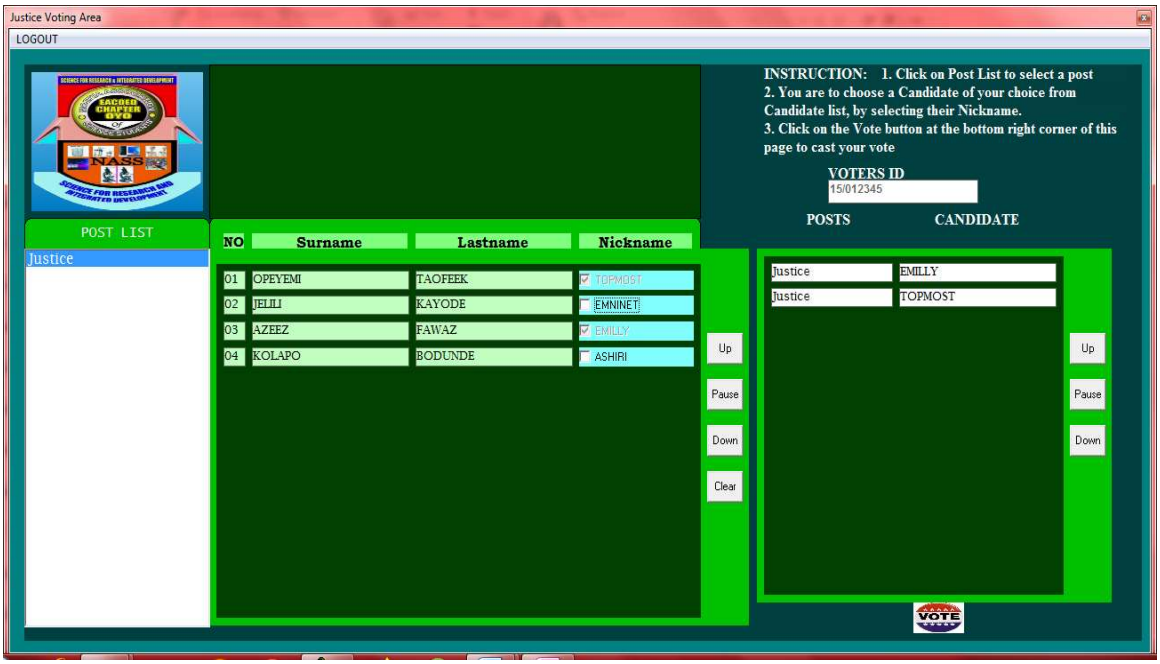

Figure 11: School Representative and Judiciary Candidate voting form

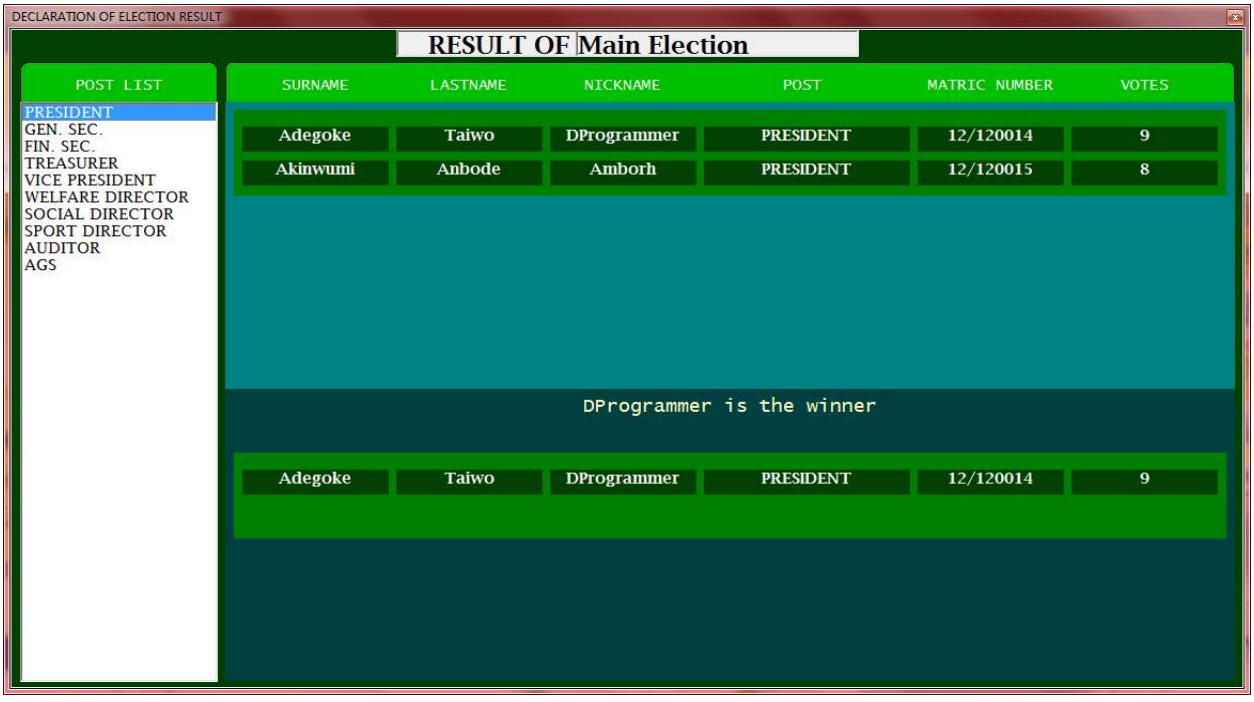

Figure 12: Declaration of CEC Election Results form

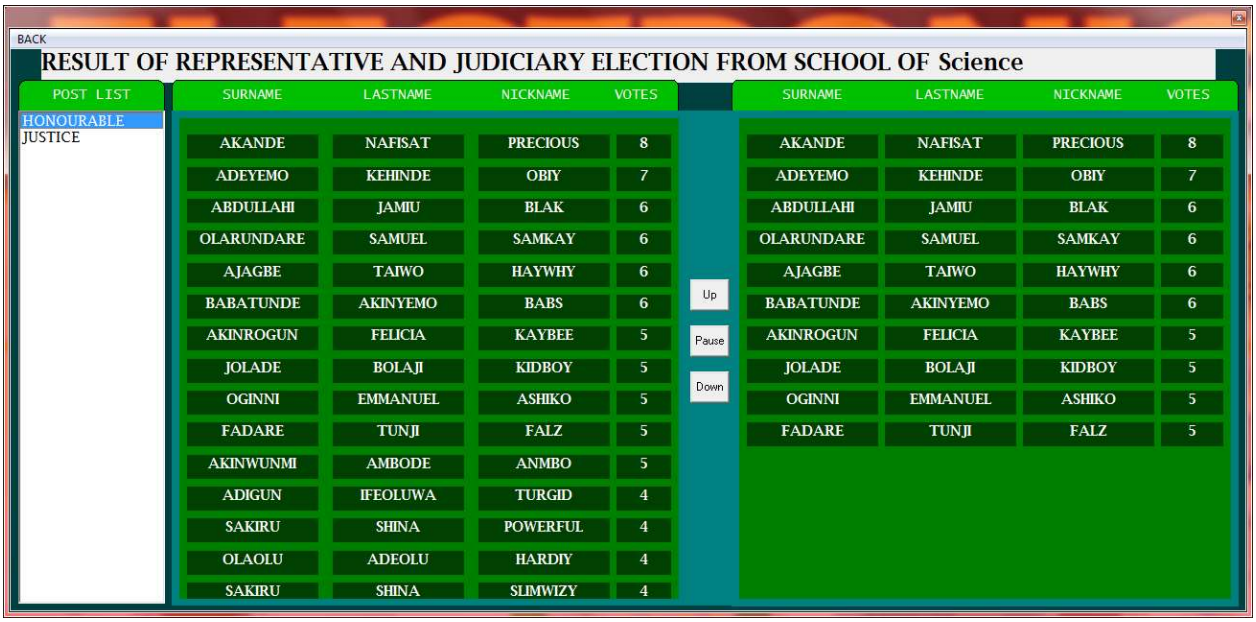

Figure 13: Declaration of School Representatives and Judiciary Election Results form

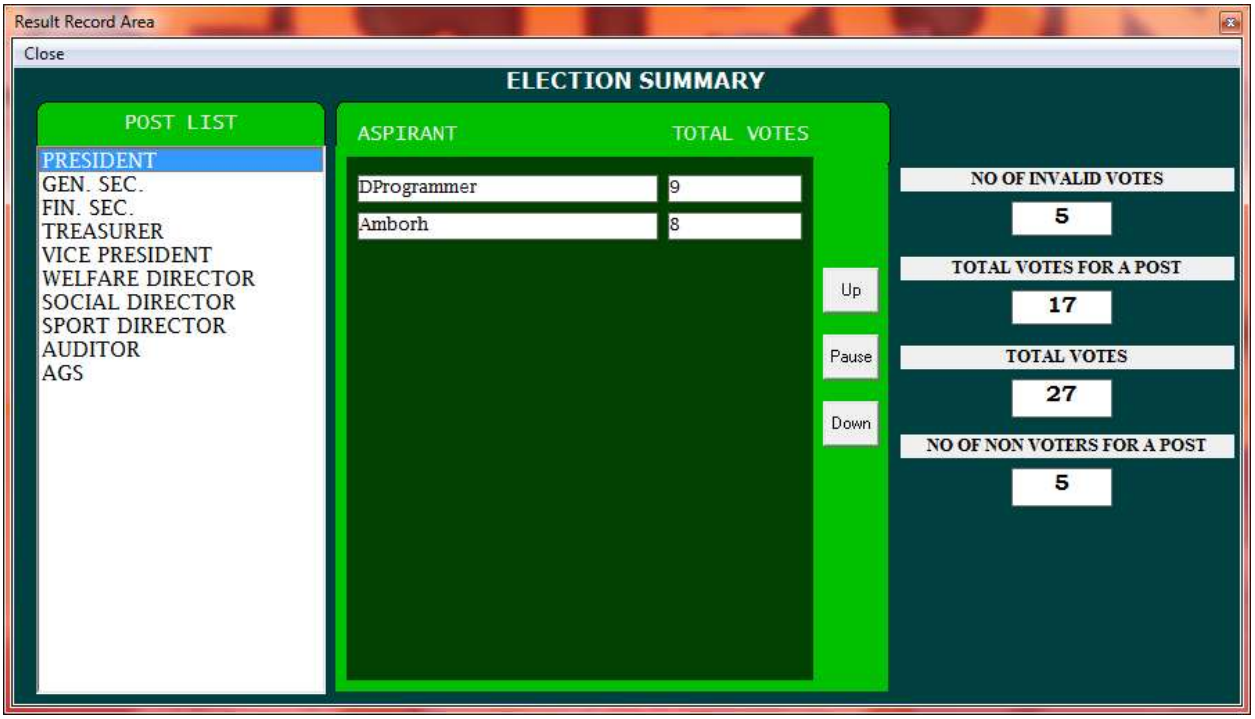

Figure 14: Election Results Summary form

Implementation
The system was implemented using VB6 and Ms-Access. The system requires the following as the basic requirements:

Hardware
512 MB RAM 50 GB HDD, 1.5 GHz

Software
Windows Xp
VB6

7.CONCLUSION

Conducting student union elections in Nigerian tertiary institutions have become worrisome and daunting due to unforeseen circumstances that emanate in the process. The manual method being currently used in most of the Nigerian tertiary institutions is characterized with fraud, delay of election results, rigging, intimidation, etc. Based on this, this study developed electronic voting system (EVS) for the conduct of students' union election at Emmanuel Alayande College of Education, Oyo. The EVS eliminate the challenges of delay of election results, high cost, rigging during the voting and vote count process. This system is an offline system eliminating the opportunity for attack by hackers through the internet.

The integrity and accuracy of the voting system eliminate the biases and doubts that typically accompanies Student Government elections which has resulted in violence in several academic institutions leading to injuries, loss of lives, destruction of properties and disruption of core academic activities and calendar (Adekitan, Matthews, John and Uzairue, 2018). The EVS is efficient and easy-to-use graphical interface, saves money and time requirement, accurate, secured, provides anonymity for voters, and it authenticates voters making it the preferred voting platform during upcoming EACOED SUG elections.

8. RECOMMENDATIONS

The following suggestions are hereby recommended:

1. Management of the Emmanuel Alayande College of Education should put the E-Voting System technology to practice in conducting students' union election to phase out the traditional voting system.
2. Students should be well trained on how to effectively use the system.
3. Management should put in place adequate facilities to effectively implement the EVS.
4. Proper maintenance routine should be put in place for smooth running of the system.

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