Online Voting System for Tertiary Institution

Mbamala C. V.

Department of Information Technology, Federal University of Technology, Owerri
vchinyere74[at]gmail.com

Abstract: *Violence, defacing and littering of institution's environment during student union election campaign have been the problem faced by manual system of voting in our institutions. In this paper we proposed an online voting system which is a paperless form of voting that will meet the electoral needs of the student union government. The prototyping model was adopted as the methodology for designing the application and MYSQL and HTML as a coding platform. It was tested to work using web browser thus WAMP server together with PHP. The system generated a more convenient voter and candidate registration interface, voter storage and count, campaign and manifest page plus immediate result compilation. The proposed system harnesses and utilizes the immense power of ICT techniques to create a striking impact in the way electoral activities are being conducted in Nigerian institutions. The goal of the system is tailored at establishing an efficient and effective electronic voting system aimed at improving students 'government democracy, and reducing electoral irregularities and malpractices in students' union elections.*

Keywords: Online voting, Students Union Government, Election security, Student politics and Violence

1. Introduction

Gathering of students to participate in student union election has been a continual challenge for student's union government in Nigeria tertiary institutions (Bonaventure et al., 2014) and also to University management because of insecurity, violence in election and moribund associated with campaign. This is as a result of the fact that election in most Nigeria tertiary institutions are manual secret ballot voting system, which holds on a single voting location where the electorates need to be physically available. This voting system is problematic as it triggers election crisis, it is inconvenient and susceptible to error and time consuming. Electoral result can easily be manipulated or altered, the electorates and electoral officers can easily be induced to act against their will. The system is not friendly to physically challenged electorates. It does not ensure security of voters and votes. It encourages multiple voting and very much error prone since vote's collation, votes counting and results compilations are done manually by humans. Institution environment and wall are being littered with posters and fliers.

Furthermore, student politics, campaign and voting can be very tense and divided among ethnic and religious groups line, just like the National politics (Uche & Odey, 2017). Several cases of SUG election violence have been recorded across the globe with number of cases in Nigeria. This is often triggered by gathering together to vote and also by various forms of malpractice and rigging. For example, on March 10, 2015 student union election at the Yaba College of Technology turned violent after invasion by thugs during the election result counting process. Sporadic shots were fired and students had to flee the collation center for their safety (Reporters, 2014). The post-election massacre of students at the Federal Polytechnic, Mubi is another critical case of student election violence resulting in the loss of lives, leaving several others severely injured in its wake (Munshi, 2014). Also, on the 24th of May, 2015, student union election went awry at the College of Education, Kangere, the resulting violence spilled from the institution to neighboring communities with several innocent people injured as a result (Ibrahim, 2017). Meddling of external

authorities in university student elections is not uncommon, this is usually geared at ensuring the victory of an anointed candidate, and such can easily trigger student revolt and violence; an example of this is the June 2016 protest and violence at the Ladoke Akintola University of Technology in Nigeria (Alao, 2016).

In India, on October 24, 2008 post-election violence erupted at Buxi Jagabandhu Bidyadhar College after student demanded for a vote recount due to alleged error (Pradhan, 2017). A similar scenario played out at Utkal University on September 17, 2017 when an alleged attempt was made to scatter the already scheduled election by rival groups (Pradhan, 2017). On September 28, 2015 at Allahabad University, series of pre-election violence erupted at the university.

Although, requirements for preventing SUG election violence are multifaceted, a major solution can be achieved by ensuring a smooth and malpractice free registration, voting and counting of election results. This can be deployed by designing and implementing an online voting system for the SUG elections as presented in this research work.

2. Previous Work

A number of studies have been done in the direction of paperless voting system. Chaum and Cytron (1981) proposed the initial concept of an electronic election scheme for the first time. Even though the first actual studies of electronic voting started in the 1990s and did not become popular until the 2000s, Chaum and Cytron (1981) alsodiscovered the first steps in creating an electronic voting system back in 1981.

Kalaichelvi and Chandrasekaran (2012) recommends the use of biometric with smart token which uses the iris pattern as a template to verify voter in the election. The voter will be verified if iris pattern template stored in the smart card matches with the real time iris pattern taken via camera.

Research paper by Aderigbe et al (2018) asserted that electronic voting system as a way to cob errors,

manipulation, and fraud, also ensures integrity in the SUG election. However the problem with their work is that it didn't solve the issues of election violence as the platform will enable electorates to gather at a place to cast their votes which can trigger violence.

According to Divya et al (2019) the software enabled a voter to cast his/her vote through internet without going to the voting booth after registering oneself for voting in advance which include storing ones data by himself in the database. The study claimed to achieve elimination of proxy vote and double voting, fast access to the software, highly secured software, easy to maintain all information of voting, highly efficient and flexible which improves voting drastically. Their system was developed using JavaScript and MY SQL as the database in both front end and back end.

Similarly Idongesit et al. (2018) used HTML, CSS, and JavaScript in front end and MY SQL, PHP and JavaScript in back end and obtain the same result. However their system does not have the feature for manifest and campaign page for online campaign which will eradicate the littering of paper and posters in the institution environment during physical campaign.

The study by Bonaventure et al. (2014) proves that " secure intranet voting system for students' union elections in Nigeria tertiary institutions" will enabled voters to cast a secure and secret ballot over a computer network within the institution, but in the above scenario voters who are not around the institution won't be able to vote and therefore will be disenfranchised. Moreover the system did not add any technology to checkmate voter from voting twice

the student union government and also meet the following electoral standard according to Cranor & Cyton (1996). [accurate, verifiability, democracy, Privacy, convenience, mobility, reliability, consistency, social acceptance, effectiveness and efficiency]. Moreover the platform will provide the following features; efficient voting interface, E-registration campaign and manifesto page, instant result generation, student's forum etc. which will help the institution to save time, stick to best practices and hence replace the current inefficient manual voting system. Analyzing all these work, it is observed that online voting system for tertiary institution covers every aspect lagging.

1) The system generates efficient voting interface which will enable electorates to vote at their comfort zone.
2) Campaign and manifest page which will enable contestant to campaign online, upload their manifest, answer questions that might crop up from students who think they are incompetent and also save the institution environment, walls from being littered with posters and fliers and moribund associated with campaign.
3) Instant result generation
4) Improve security
5) Online registration

A six step prototyping model was used for the development of this application. The phases of the development model included:
1) Requirements Gathering
2) Quick design
3) Prototype Building
4) User evaluation
5) Refining prototype
6) Implementation and maintenance

3. Proposed Approach

In this paper we proposed an online voting system which is a paperless form of voting that will meet the electoral needs of
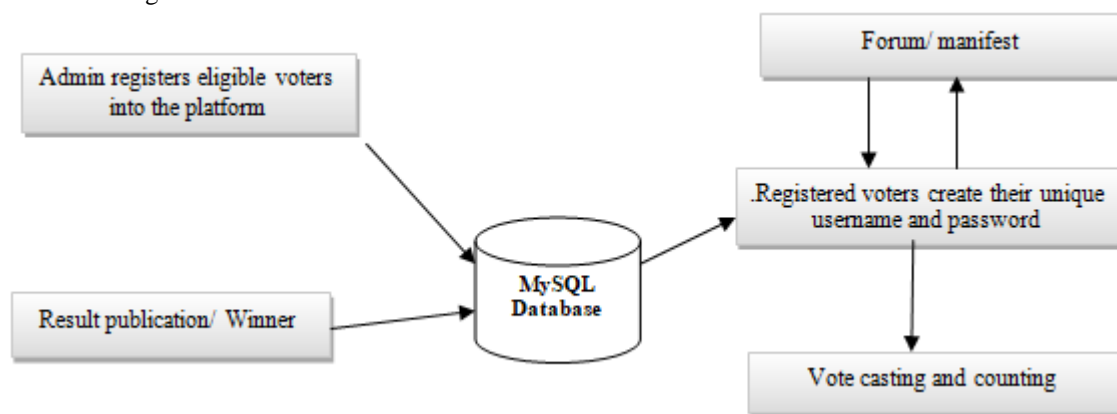
4. Design and Framework

Figure 1: Simplified architecture of the online voting system for tertiary institution

With reference to the architecture, firstly the administrator registers the students/contestant using the proposed online platform with the following data; student matriculation number, student name, Department, student level, school fees receipt number, post being contested, candidate picture and Candidate Identification Number (CIN). The CIN is the primary key in the database which students who want to vote will use to identify the eligible candidate to vote for. The above data were gotten from the department, vetted and

approved by the SUG electoral commission (Eleco). All the information registered are stored in the database. Furthermore the registered voters will login using his/her Matric. No. and School fees receipt No. to generate a unique user name and password which he/she will use to execute his/her franchise, this is an inbuilt security to avoid impersonation. When a voter logs on without being formally registered by the admin, he/she will be prompted to contact the admin for registration. Additionally the platform has

pages we called manifest where the contestants campaign with his/her CIN which the voters will use to identify him during the election and also voters forum which the voters will use to interact within themselves, comments and ask questions of their concern to contestants. On the election day, the voter logs in with the unique username and password created by himself, the voter supplies the CIN of the particular contestant which will display the profiles of the contestant and click the vote button to cast his or her votes, which will be automatically counted and stored in the database for that particular contestant. After the election the students can log in to view the total vote for each contestant and the winner for each position.

The users of this project include Administrators, voters, and contestants. By using information technology, it is believed that the proposed system will enable votes to be cast and counted with higher convenience, efficiency, improved performance and security. Hopefully, it will thus simplify the electoral process, eliminate election and campaign crisis. Hence reduce the pressure of manual voting.

User Requirements for the Proposed System
The Online Voting System should
1) Be able to display all registered voters in the database to the Admin and Eleco.
2) Have a user-friendly interface and user guides understandable by people of average computer skills
3) Be robust enough so that users do not corrupt it in the event of voting.
4) Be able to handle multiple users at the same time and with the same efficiency
5) Be scalable (for future expansion)

Security Requirements
1) An individual not registered to vote must not be able to cast a ballot.
2) A voter must not be able to vote more than once.
3) The privacy of the vote has to be guaranteed during the casting, transfer, reception, collection, and tabulation of votes.
4) No voter should be able to prove that they voted in a certain way.
5) organizers, election officials, trusted third parties, voters, etc. are not involved in the voting process
6) An eligible voter generate his/her unique username and password.
7) Vote is submitted over a network to a secure online database.

8) Voter will be denied re-voting after the first successful one.
9) The outcome of the voting process must correspond to the votes cast.
10) The system cannot be re-configured during operation.
11) Access to voted ballots is prohibited until after the close of polls.
12) Additional ballots cannot be cast once the polling has ended.
13) The system must be open to independent inspection and auditing.
14) The system should be added campaign and manifest page to avoid gathering of students which triggers physical conflict.
15) The system should be protected against accidental and malicious denial of service attacks.

Input Requirement
The input design depends on the type of output required. It involves data collection methods and validation which is done online or offline. It is structured and interactive. The major input requirements of the online voting system are listed below:

Student Membership Information:
This holds information about the students that have been registered in their various departments uploaded into the database.

Table 1: Admin student input design

Student Matric No	Student Name	Department	Student level	Receipt

Candidate Information:
This is basically information about the students that are contesting for a positions in SUG election.

Table 2: Candidate input information

Candidate_Id	Candidate_Name	Department	Candidate_level	Post contesting	Vote count

Other input design tables include: Student input Design, Submission of votes Information Input Design, Output Requirement Design, Qualified candidates to be voted for Input Design, Registered students Input Design, Result of election Output Design.
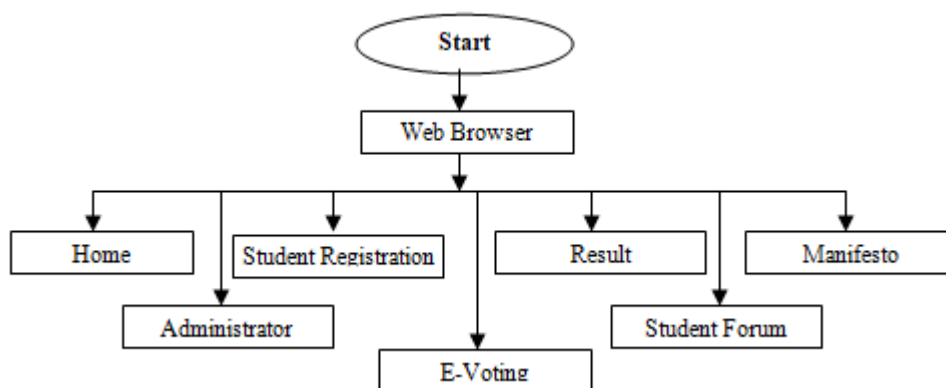

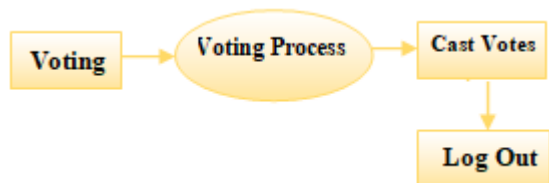**Figure 2:** High Level Model of the proposed online Voting System

Figure 3: Online Voting System Dataflow Diagrams

Database Design
The Online Voting System uses a database called Unievote which comprises of five (5) tables as illustrated below:

Student table holds the information about students/voter who has been successfully screened by electoral commission and entered by administrator who manages the system

Table 3: Student Membership Information Table

S/No	Field Name	Type	Size
1	Student Matric No	VarChar	20
2	Student Name	VarChar	35
3	Department	VarChar	35
4	Student Level	VarChar	5
5	Receipt	Integer	10

Contestant Information:

Table 4: Candidate Information Table: This is basically holds the information about the students that is contesting for a position in SUG election.

Field	Type	Size	Primary key
Candidate_ id	Vchar	20	Yes
Candidate_ Name	Vchar	35	
Department	Vchar	30	
Candidate level	Vchar	5	
Post_ contesting	Vchar	35	
Vote Count	Integer	10	

Student Registration Information:

Table 5: Student Registration Information Table. This table holds information about the students that successfully generates Username and password for him/herself after being captured by the administrator on the table above.

S/No	Field Name	Type	Size
1	Student _Name	VarChar	35
2	Student_Sex	VarChar	7
3	Phone No	VarChar	15
4	Student_Level	VarChar	5
5	UserName	VarChar	20
6	Password	VarChar	15

Other tables include Admin table, and tracker table.
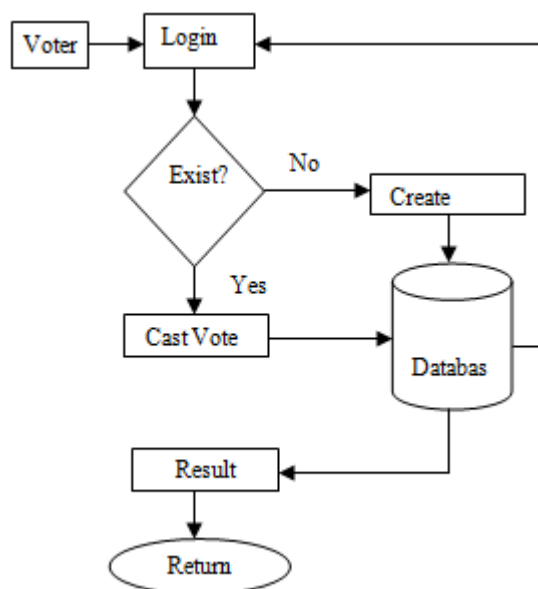

Figure 4: Voter flowchart diagram

5. Development and implementation

System implementation is the practice of creating or modifying a system to create a new or replace an existing business process. It consists of converting hardware and files to the new system and also of training the user on how to handle the system. The system was developed as an interactive mechanism between the user at the interface and the database using the web-browser. This tool enables a user through a web browser to interact with the MYSQL database to enter, edit, view and retrieve such data as per the privileges granted. HTML forms offer the best layout to enter data, change and view the database. These forms were also kept as short and simple as possible for easy public awareness on the use of the tool. The interfaces and forms created include the following:

The Home Page/User Login Page
On visiting the Online Voting System site, this is the first page the user interacts with. It can also be called the Index page. It serves as the starting point to prospective users (Admin, contestant and Voter). The individual is required to register and/or provide a username and password for authentication into the system.

Figure 5: The Home page / User log in page

Figure 6: The candidates Registration form

Figure 7: Student Login Page

Student registration page

Students uses this page to create a unique user name and password

Figure 8: Students Registration page

Voting page

This is the voting page where the actual voting is done. A voter logs in using his/her unique username and password, searched for candidates of his/her choice using the candidate Id No, then cast his or her vote. Once a vote is cast by the user, he/ she cannot go back to vote for the same person.

Figure 9: Voting page

Figure 10: Election Result Page.

User Manual

To register double click on your web browser. Type the following address in the address bar: www.unievote. net and click on "Enter" key. Fill the student registration form, generate your unique password and username and click "submit". This is after you have been successfully registered by admin.

To vote Login with your user name and password and then enter the candidate Id No and click submit, the profile of the candidate will display then click vote.

Note that once you have submitted the vote to a particular position, you cannot go back to make changes.

To write comments or ask the contestant question, Login with your username and password click on students forum comments. Then write your comments and question with inclusive of the name who's the question is made for. To view manifest, also login, click on manifesto and go through the contestant manifest.

Testing

Testing is the process of running a system with the intention of finding errors or checking if it is working well by meeting the parameters established for it. The Online Voting System was designed to run on a web browser thus a WAMP server together with PHP as a coding platform (which is basically built to test websites to see if the expected functionalities are met before finally uploading it online) was installed to test the system and was confirmed to be logically and functionally correct and working as shown in the snapshots above.

6. Findings and Discussion

Thus some of the goals and expected outcome of the system application with respect to the online voting system for Student union Government.
1) Faster vote count and tabulation.
2) More accurate results as human is excluded.
3) Increased convenience for vote.
4) Improved presentation of complicated ballot papers
5) Potential increased participation and turnout.

6) Prevention of fraud in polling stations and during the transmission and tabulation of results by reducing human intervention.

7) Potential long term cost savings through reduction of costs for the production and distribution of ballot papers.

7. Conclusion and Recommendations

This paper has come as a platform to propose an online voting system that will place our democracy on a path of success. In a nutshell, this research seeks to increase the efficiency of voting process, increase the number of voters, eliminate the electoral crisis, noise and littering of fliers and posters during election campaign. This Online Voting System is simple and indigenous. It has an authentication feature that will manage the Voter's information by which voter can login and use his/her voting rights. There is a database in which all the names of voters with complete information is stored and it provides the tools for maintaining vote of every candidate and also computes the total number of votes of every candidate. Online voting offers speed and convenience, it generates the result instantly after the election than conventional methods of manual voting.

Recommendations

There should be use of biometric capturing devices, which will serve as a means of voter's authentication. There should also be adequate and proper public enlightenment before the system is fully implemented.

The Online Voting System can be used for different elections.

In this project we handled election for just SUG, but this same system can be used in future for conducting different elections like Faculty election, Dean's election and even national elections. The only requirement is that we need to create the whole voters database.

Provide for transparent auditing and certification.

Online Voting Systems should be certified by an independent agency and audits should be conducted throughout the process to allow independent confirmation of the results produced. Certification and audits are important confidence-building measures and should be transparent, allowing stakeholder's access to related procedures and documentation.

Plan for training, professional development, civic and voter education.

Well-informed voters will not only find it easier to use online voting on election day; they will also find it easier to trust a new system if they understand why it is being introduced, what benefits it brings and the various security measures that are built to support the integrity of the election.

Consider sustainability issues and plan for the future, not only for today.

The cost of introducing an online voting can already be very high, but to remain secure and trustworthy online voting systems need continuous reviews, upgrades and replacement as well as adjustments to new requirements. When considering the costs of e-voting it is important to consider the total cost of maintenance over time rather than the one-time purchase costs.

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Author Profile

Mbamala Chinyere V is an assistant Lecturer at the Department of information Technology, Federal University of Technology, Owerr, Imo state. She obtained a BTech Mathematics and Computer Science (computer science option) at Federal University of Technology owerr in 2008, Master of Science Degree in Computer

Science at the Imo state University, in 2014 and currently running her PhD programme at Nnamdi Azikiwe University, Awka. Her research has focused on Data communication and Network. She can be reached by phone on +2347069178469 and through E-mail vchinyere74[at]gmail.com