An Online Voting Platform for Nigeria's Independent National Electoral Commission

Njideka Mbeledogu[1], Ikechukwu Umeh[2], and ChukwuNonso Nwokoye[3], and Obiajulu Ositanwosu[4]

njidembeledogu@yahoo.com   ikumeh1@gmail.com   chinonsonwokoye@gmail.com   oe.ositanwosu@unizik.edu.ng

[1,2,3,4] Department of Computer Science, Nnamdi Azikiwe University, Nigeria.

Abstract

Elections in Nigeria has been plagued by vote buying, ballot box snatching, weak and independent (but dependent on the Executive) electoral management body, corruption and legitimacy crises as well as other forms of election malpractice, violence and irregularities. To curb the incidences of fraud, malpractice and the flagrant absence of transparency, this study introduces the concept of the design and implementation of an online voting platform (OVP) for the Independent National Electoral Commission (INEC). This application implemented with Python, a powerful web programming language suggests an impartial, electronic and easily managed form of conducting gubernatorial elections (in one of the states) in Nigeria. The database was created using MySQL. The analyses and design of the web application involved some unified modeling diagrams (case, class). The web application promises to eradicate several weakness of the existing system such as slower vote counting, physical location for conducting the gubernatorial polls, inconsistencies and errors resulting from the manual tasks, costliness of the election and most especially delay/ time wastage.

Keywords:
Website, Independent National Electoral Commission, Python, Electronic voting, Web development methodology, E-government

1. Introduction

In developed societies, vote casting has become a significantly essential part of human existence. To a large extent it aids the amplification of the voice of the people. Voting is a fundamental part of democracy and its attendant practices. In the words of Hosany & Chedembrun [1], "voting is generally perceived as a medium for promoting democracy, establishing belief in electoral management, adding integrity to election outcomes and improving the overall efficiency of the electoral process". Democracy is the most applauded and commended system of government because it allows for an elevated degree of involvement of the masses in the making of decisions concerning who leads for the next tenure [2,3]. By implication, vote casting is a paramount factor which determines the nature of the electoral process and presents a competitive yet fair method and institutional structure for selecting worthy representatives. In order to achieve democracy developing countries such as Nigeria, have increasingly used the traditional voting

system (TVS). As Ofori-Dwumfuo & Paatey [4] puts it, "traditional voting system also known as ballot voting system is a method by which recording and counting votes are carried out on paper cards. For this type of election, the most well-known approach to voice out one's decision is voting at a particular area known as the polling station." TVSs are categorized into numerous kinds, and they include majority rule, proportional representation, semi-proportional representation, plurality voting, and preferential voting etc. Nigeria's Independent National Electoral Commission (INEC) mostly practices the majority rule, a situation where the decision rule adopts the aspirant or contestant that has the major part of the casted votes by the electorates.

In Nigeria, election are conducted by INEC for Presidency, Senate, Federal House of Assembly, Governorship etc. Therein, the TVS also regarded as the ballot system of vote casting is employed. This process allows the manual recording and counting of votes using paper cards. Using the most well-known method of speaking out one's opinion, the electorate goes to the polling stations to cast their votes. This method of conducting elections have been fraught with a lot issues and challenges. Some of these issues include electoral violence i.e. ballot box snatching [2,5], weak and independent (but dependent on the Executive) electoral management body [6], corruption and legitimacy crises [5] as well as other forms of election malpractice, security of election materials [7] and irregularities [7].

Unfortunately, "In Nigeria, however, elections have been one of the main problems of the democratic process" [6]. The conduct of free and fair elections has always been a problem which continues to threaten the very survival of the country and questions the relevance of democracy. Corroborating this, Jega (the former Chairman of Nigeria's Election Management Body- Independent National Electoral Commission INEC) asserts: "A series of badly conducted elections could create perpetual political instability and easily reverse the gains of democratization... it can be argued that the consequences of badly conducted elections and poorly managed electoral processes are major contributing factors to military interregnum in Nigeria's political history [8]." Other forms of issues/challenges are listed in Animashaun [9]. To curb the incidences of fraud, malpractice and the flagrant absence

of transparency, researchers have introduced mobile applications. These applications are developed and implemented on smart devices to aid, simplify and make effective the related process of voting. In other field of life and in this time and age, mobile applications can be seen to raise the quality of living; allowing the designed apps to dictate the world just by moving screens using fingertips. More so, its electronic voting systems would in no small way improve the quality of all attributes of the election process.

Furthermore, the consequences of these challenges have continuously affected the democratic progress of the Nigerian state. To a large extent, the design and implementation of an online voting system (OVS) would eliminate the existent manual nature of conducting elections; which are prone to the above-mentioned challenges. In the light of the above-identified merits of e-voting system, this study attempts to investigate and explore the implications of conducting the Governorship elections in Nigeria using automated, paperless medium i.e. an online voting platform (OVP).

2. Related Works

On the review of pertinent literature, firstly, we x-rayed several issues surrounding the manual type of vote casting. The following studies showed the shortcomings experienced by the Nigeria populace over to time. Finally, we reviewed electronic voting systems which to an extent may avail some panacea to challenges of conventional voting. In electronic voting, voters are aided by an automated equipment, and this possesses several advantages such as speed, intelligibility, accessibility and transparency [10]. While Mazumder & Roy [11] summarized electronic voting systems as; direct-recording electronic (DRE) voting system, optical scan, punch card voting and internet voting, Sanjai & Umamaheswari [10] maintained that online voting may be conducted in the following approaches; poll site internet voting systems, regional poll site internet voting systems and kiosk internet voting systems.

2.1 Review of Issues Encountered in Nigeria Voting Systems

Hereunder, we reviewed several authors who has recent times lent their efforts in deciphering the challenges experienced by INEC (and the Nigerian electorates) in the conduct of elections. The following challenges provides the required rationale to invest a considerable amount of effort to the development of an online platform for conducting elections in a state in Nigeria.

Osinakachukwu & Jawan [12] showed that rigging has culminated to the introduction of blemished leaders who possess no respect for democratic fundamentals.

Folarin, et al., [13] evaluated attendant issues on elections and discovered infrastructural constraints and lack of trust in the government of the day. Nnamani [14] found that the large percentage of violence attributed to elections has been on the increase. More so, the political elites now recruit jobless youths into custom-made instrument for continuing and maintaining violence. David, et al., [3] established that the electoral procedures have been deformed by abuse, rigging, snatching of ballot boxes, vote buying and late appearance of voting tangibles for polls. Odusote [15] showed that democracy and the process of election are strongly influenced by the diversity and varied interests in Nigeria.

Idike [16] assessed the optimism of e-voting success but concluded that "access to modern information and communication facilities (should first) become fundamentally democratized", before deploying it. Adibe [17] investigated the concept of free and fair elections and concluded that the shortcomings of INEC has basically proliferated the anarchic nature of Nigeria's election. Isma'ila & Othman [5] reviewed democratic dispensations and maintained that there is a strong link between corrupt practices, violence, adversities of legitimacy and electoral falsehood. Bariledum, et al., [18] x-rayed the Nigeria political landscape focusing on election-related fraud and found that electoral malpractices erodes the foundations of participatory democracy. Isma'ila & Othman [19] confirmed the existence of the following; "ballot-box stuffing, misreporting, under-provision of voting facilities in opposition strongholds, lack of transparency in the organization of the election and bias". Mgba [6] confirmed that the identified oddities requires the urgent implementation of electoral reforms that will result to an improved election in Nigeria.

Alausa & Akingbade [20] proposed the development and implementation of an Electronic Voting System (EVS) but this system was neither implemented nor tested, thus, providing the rationale for our study herein.

Peter & AbdulRahman [21] enumerated causes of violence; "weak electoral laws, poverty, unemployment, hate speech (via social and media), and lack of effective collaboration by security agencies leads to post-election violence". Chukwu, et al., [22] maintained that since the inception of democracy in 1999, elections became absent of legitimacy due to weapon brandishing and violence of political godfathers. By adopting quantitative and qualitative approaches, Zainawa [23] studied the interconnection between political elites and problems of organizing a freestanding, just and acceptable election, with bias to 2007 and 2011 elections. Idakwoji, et al., [24] pinpointed the several forms of corruption existent in electoral procedures for primaries and nominations conducted by Nigerian political parties.

The International Republican Institute (IRI) and National Democratic Institute [25] on the 2019 election

observation highlighted several challenges: they include card reader failures, leading to the manual verification, late distribution funds, INEC's non-transparency on their logistics, delays in revisions to the electoral framework and the marginalization of groups. Adekola & Olumide [26] identified issues suc as ballot box thievery, multiple voter registration, fraudulent doctoring of electoral regulations, rigging, vote buying and the assassination of politicians. The causative factors include; "lack of planned manifesto, political cynicism, illiteracy, poverty, and the lack of effective legislation and strict adherence to the rules of the game." Mbah, et al., [27] showed that hate speech and ethnicity causes distrust and insecurity. In summary, the above review elicited numerous factors attendant to conventional voting method.

2.2 Review of Electronic Voting Systems in Countries: An Empirical Study

Here, we reviewed the extant literature on electronic voting system so as to elicit several pertinent features that can be exploited to enhance the election of credible candidate in Nigeria. Clarkson, et al., [28] built Civitas – the first electronic voting system that is coercion-resistant, universally and voter verifiable, and suitable for remote voting. Tornos, et al., [29] described the implementation of a secure e-voting system, based on ring signatures providing multiple features such as link-ability or anonymity. Bell, et al. [30] developed STAR-Vote – which currently uses a DRE voting system. Tornos, et al., [31] describes a secure eVoting protocol based on ring signatures. The implementation details and the different modules of a voting platform including this signature protocol are presented. Springall, et al., [32] analyzed the Estonian I-voting system based on a combination of in-person election observation, code review, and adversarial testing. Sultan, et al., [33] discussed an online voting scheme using biometric and password based security that makes use of fuzzy extractor to provide biometric based authentication.

Chondros, et al. [34] presents the design, implementation, security analysis, and evaluation of D-DEMOS e-voting system. Naidu & Kharat [35] discussed a secure authentication based on biometric features that use visual cryptography to provide confidentiality to the biometric database. Kshemkalyani, & Bandekar [36] developed an OVS encompassing a range of Internet services from a touch screen kiosk at a polling station to voting online. Hosany & Chedembrun [1] analyzed, designed and implemented an android based application for student voting. Habibu, et al., [37] developed a voting system that allowed casting of votes in convenient medium. Rura, et al., [38] designed and implemented an OVS based on image steganography and visual cryptography. Eteng, et al., [39] designed an OVS to meet the electoral needs of universities and colleges using the prototyping model. Sanjai & Umamaheswari [10] developed a system to mitigate electoral issues in India. Dwivedi & Mam [40] designed and implemented a system improves the voter turnout.

3. Methodology

Through techniques of data collection and fact finding employed in this study, which are interview, observation as well as the review of procedural manuals and other documents, we elicited several weaknesses attendant to the existing system. The shortcomings include slower and manual vote counting, polls are conducted in a physical location and it is largely expensive. Other include manual vote handling, time consumption, and routine tasks are prone to inconsistencies and errors. To design the accurate problem solver (software) i.e. one with solutions to the encountered problems, the web development methodology (WDM) [41] would be employed (Fig. 1).

Fig. 1. Web Development Methodology

With WDM, our major objective is to appreciate the needs of INEC as well as the user (voter) and to develop an application that characterizes what was gleaned, thus, leveraging the organization. The innovation of migrating voting process from manual WDM has five stages which include; Requirement gathering, system analysis, planning and designing, implementation and testing/quality assurance.

3.1 Requirement Gathering Stage

The proposed system possesses some requirements which should be met for it to effectively perform. The system presents a dynamic platform required by users i.e. election (INEC) officials, system administrators and the voters for the selection of a credible candidate. Our system mimics the conventional form of vote casting where the voters are essentially rationale underlying election approaches and its development. More so, the voters are members of the populace whose needs include a secure,

time-efficient and easy electronic system for conducting polls. The proposed system applies information technology for the achievement of the above objectives. With the new system, the responsibilities of the INEC officials who man polling locations are basically automated but managed by IT personnel. Therefore, it is advised that they are retrained to provide security against imminent cyber threats. The management and maintenance of the electronic system are performed by the system administrators. These kind of users ensure that user eligibility and registration are maintained without altering the system in a fraudulent manner. On the one hand, the functional necessities are the duties which the system is expected to carry out in a real voting scenario. They include authorization, authentication and documentation. On the other hand, the requirements of the users garnered at this phase include flexibility (users can access it anywhere), comfortable, wholeness (all bonafide votes are accurately counted), suitability (eligible voters are allowed), and non-reusability (votes cannot be casted more than once by a single voter), privacy, integrity, confirmable (the results is a true reflection of qualified and balanced ballots), unwavering and equity.

3.2 System Analyses

Here, we directed thought towards both graphical and functional requirement of the proposed system. On the graphical issues, analyses involved color schemes, logos, as well as other graphics to be employed. More so, there was the addition of navigation items as well as search boxes which allows quicker access to site information. For the color, we choose white, green, black, faded cyan and blue; while for logo/graphics we incorporated the map of Nigeria and the insignia of the registered political parties in the state. On the functional requirement analysis, we use diagrams of the unified modeling language (UML) to describe the required functions of the online platform. These diagrams were used to clarify the needs of Nigerian election which include "voter registration, registration review/update, electioneering campaigns, actual voting, and release of election results" as identified by Folarin, et al., (2014). Fig. 2 and Fig. 3 are the use case diagram and class diagram for the Online Voting Platform, respectively.

3.3 Design

At this juncture, we used the information generated from the graphical analysis above in order to develop a prototype of the online platform. But here we focused on creating templates for moving through proposed web functions. Furthermore, the prototypes are equipped with the identified essential components; this is done with users (INEC officials and voters). This active involvement of potential users allows for heightened usability of the final

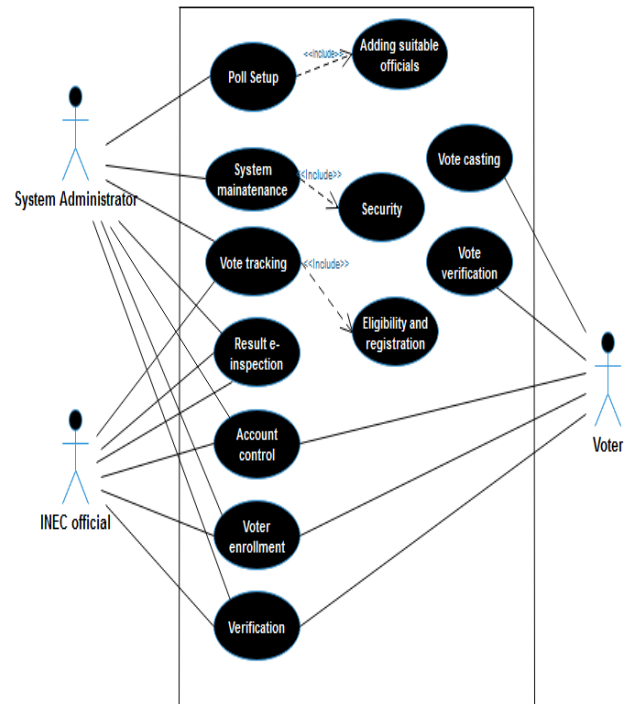product and this is the ultimate aim of any application developer.

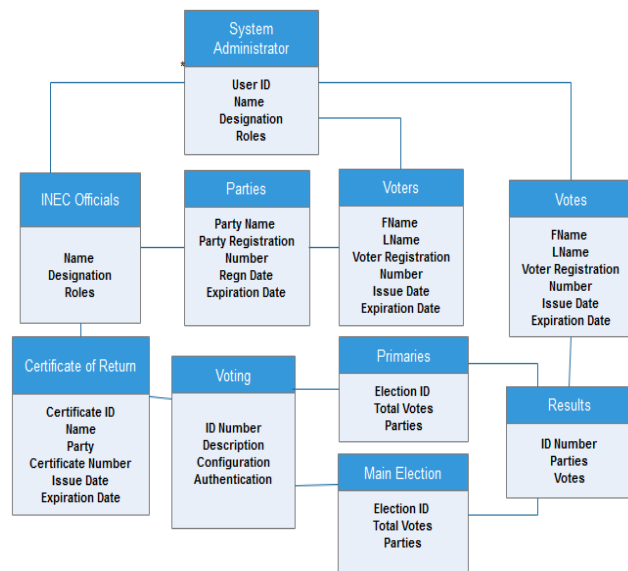Fig. 2. Use case diagram for the Online Voting System

Fig. 3. Class diagram for the Online Voting System

3.4 Implementation and Testing

The actual coding is done with Python 3.6 while the database was created using MySQL. Python was chosen for actual coding due to several identified benefits including its free and open source nature, portability, and

extensibility as well as its extensive libraries. First, the smaller modules are created and they are subsequently incorporated to meet several stipulated specifications. As soon as we completed the development of the components/modules, the database and other web files were moved to the production server for implementation. Finally, several tests were performed to detect any form of errors and they were eliminated according to user needs.

Some of the developed pages are presented below. Fig. 4 is the home page of the system which also allows the display of the results. Fig. 5 is the INEC Parties' Page; some of the listed political parties are All Progressives Congress (APC), All Progressives Grand Alliance (APGA) and People's Democratic Party (PDP). Fig. 6 and Fig. 8 are the signup and sign pages respectively. While Fig. 9 represents the voter registration page, where voters do the actual registration for the election, Fig. 10 allow the vote casting in both primaries and the main gubernatorial election.
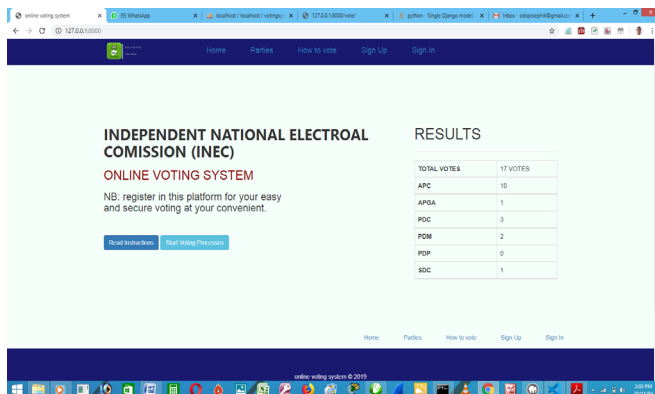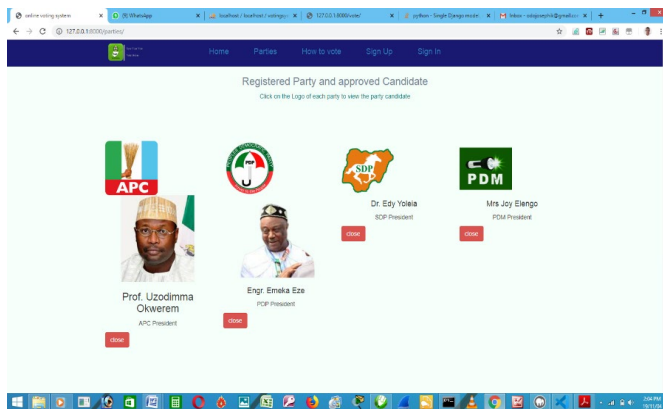

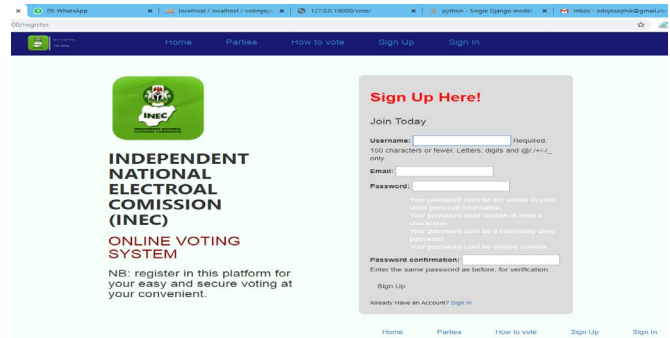Fig. 4. Home Page of the Proposed OVP
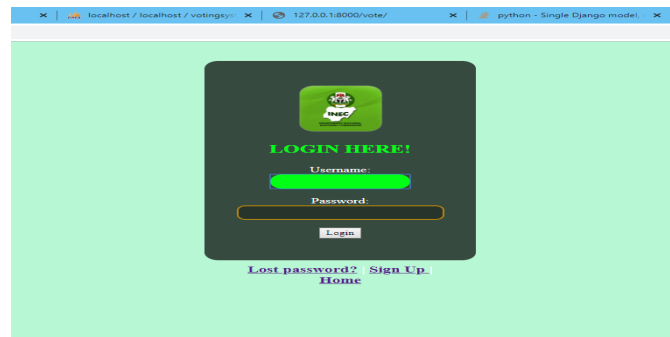

Fig. 5. INEC Parties' Page

Fig. 6. Sign Up Page

Fig. 7. Sign In Page

Fig. 8. Voter registration page

Fig. 4.9. Vote Page

4. Conclusion

In view of the study aims/purposes which include provision of accurate, timely and relevant results, better management, error reduction, design of a user-friendly

interface, provision of a better storage mechanism and overall automation, it is clear that the efforts expanded to design and implement a web application is a fruitful one. Going by the above assertion the OVP eliminates the identified weaknesses (manual operations) and avail the institution the opportunity of smooth management, administration and close-to-perfect decision making. Considering some limitations such as time and funds as well as the scope, this report may not have provided a comprehensive approach to conducting elections in Nigeria. Therefore, new researchers interested in web development can expend research efforts in order to extend the application to include other types of election i.e. presidential, senate, and house of representative. Additionally, as storage might be an issue, further research might be directed to including a cloud functionality for the OVP.

References

[1] M. A Hosany, and N. Chedembrun, "Design and implementation of an online voting system for the election of students of the University of Mauritius," International Journal of Advanced Research in Science, Engineering and Technology, vol. 4, pp. 7-21, 2017.

[2] M. A. Ali, A. F. Dalaram and M. Dauda, "The challenges and prospect of free, fair and credible election in Nigeria. A theoretical perspective", International Journal of Management Research & Review", vol. 8, pp. 42-53, 2018.

[3] N. A. David, Y. A. Manu, and A. Musa, "Elections, electoral process and the challenges of democratization in Nigeria's fourth republic", Research on Humanities and Social Sciences, vol.4, pp. 93-102, 2014.

[4] G. P. Ofori-Dwumfuo and A. Paatey, "The design of an electronic voting system", Research Journal of Information Technology, vol., 3(2), pp. 91-98, 2011.

[5] Y. Isma'ila, and Z. Othman, "Challenges of electoral processes in nigeria's quest for democratic governance in the fourth republic", Research on Humanities and Social Sciences, vol.5, pp. 1-10, 2015.

[6] C. Mgba, "Electoral management body and the challenges of conducting credible elections in Nigeria. American International Journal of Social Science," vol. 6, No. 3, September 2017, pp. 85-96.

[7] Independent National Electoral Commission (INEC) & Friedrich-Ebert-Stiftung (FES), Nigeria. Election security in Nigeria: Matters arising. Eddy Asae Nig. Press, Nigeria. pp. 23-76, 2013.

[8] A. Jega, "Electoral reforms in Nigeria: Prospects and challenges", 7th International Electoral Affairs Symposium, in Kuala Lumpur, Malaysia, pp. 9-25, 2013.

[9] K. Animashaun, "Regime Character, Electoral Crisis and Prospects of Electoral Reform In Nigeria" Journal of Nigeria Studies, vol. 1, pp. 34-46, 2010.

[10] M. Sanjai and R. Umamaheswari, "An efficient and securable online voting system, Gnanamani College of Technology, India, 2018.

[11] S. Mazumder and B. Roy, "Design and strategies for online voting system", International Journal of Computer Applications, vol. 142, pp. 33-39, May 2016.

[12] N. P. Osinakachukwu and J. A. Jawan, "The electoral process and democratic consolidation in Nigeria", Journal of Politics and Law, vol. 4, pp. 128-138. 2011.

[13] S. Folarin, C. Ayo, A. Oni, and D. Gberevbie, "Challenges and prospects of e‑elections in Nigeria", Proceedings of the 14th European Conference on eGovernment, , Romania, pp. 93-100, 2014.

[14] D. O. Nnamani, "Electoral process and challenges of good governance in the Nigerian state (1999-2011)", Journal of Good Governance and Sustainable Development in Africa, vol. 2, pp. 78-99, 2014

[15] A. Odusote, "Nigerian democracy and electoral process since amalgamation: Lessons from a turbulent past", IOSR Journal Of Humanities And Social Science, vol. 19, pp. 25-37, 2014.

[16] A. N. Idike, (2014). Democracy and the Electoral Process in Nigeria: Problems and Prospects of the E-Voting Option. Asian Journal of Humanities and Social Sciences, vol. 2, pp. 133-141, May 2014.

[17] J. Adibe, INEC and the challenges of free and fair elections in Nigeria. pp. 1-21, 2015.

[18] K. Bariledum, O. P. Abang, and T. S. Nwigbo, "The political ecology of election in Nigeria and the fragility of democratic sustainability", Global Journal of Political Science and Administration, vol.4, pp. 9-19, 2016.

[19] Y. Isma'ila and Z. Othman, "Challenges of electoral malpractices on democratic consolidation in Nigeria's fourth republic", International Review of Management and Marketing, vol. 6, pp. 103-107, 2016.

[20] D. W. S. Alausa and L. O. Akingbade, Electronic voting: Challenges and prospects in Nigeria's democracy", International Journal of Engineering and Science, vol. 6, pp. 67-76, 2017.

[21] S. A. Peter and I. AbdulRahman, "Political and economic effects of post-election violence on national development", Net Journal of Social Sciences, vol. 6(2), pp. 18-26, August 2018.

[22] C. C. Chukwu, I. S. Ume, & S. B. Dibia, "The role of neo-patrimonialism in elections and the challenge of national security in contemporary Nigerian society: An appraisal", International Journal of Development and Sustainability, vol. 7, pp. 1800-1814, 2018.

[23] A. Y. Zainawa, "Elections and democratic consolidation in Nigeria: A study of 2007 and 2011 general elections in north-west geo-political zone", PhD Dissertation. Ahmadu Bello University, Zaria, 2018.

[24] S. P. Idakwoji, S. O. Paul, and M. Attai, "Corrupt electoral integrity: The challenge to legitimacy and good governance in Nigeria", International Journal of Innovative Legal & Political Studies, vol. 6(1), pp. 30-39, 2018.

[25] International Republican Institute (IRI) and National Democratic Institute (NDI). IRI/NDI Nigeria International Election Observation Mission Final Report. June 2019.

[26] A. A. Adekola and O. O. Olumide, "Election gifting and the ordeal of democracy in Nigeria", European Scientific Journal, vol. 15, pp. 119-131, February 2019.

[27] P. O. Mbah, C. Nwangwu, and S. C. Ugwu, "Contentious elections, political exclusion, and challenges of national integration in Nigeria. Cogent Social Sciences, vol. 5, pp. 565-615, 2019.

[28] M. R. Clarkson, S. Chong, and A. C. Myers, "Civitas: Toward a Secure Voting System", IEEE Symposium on Security and Privacy, 2012.

[29] J. L. Tornos, J. L. Salazar, and J. J. Piles, "An e-voting platform for qoe evaluation", IFIP/IEEE International Symposium on Integrated Network Management, Ghent, pp. 1346–1351, 2013.

[30] S. Bell, J. Benaloh, M. D. Byrne, D. DeBeauvoir, B. Eakin, G. Fisher, P. Kortum, N. McBurnett, J. Montoya, M. Parker, O. Pereira, P. B. Stark, D. S. Wallach, M. Winn, "STAR-Vote: A secure, transparent, auditable, and reliable voting system", USENIX Journal of Election Technology and Systems, vol. 1, pp. 18-37, 2013.

[31] J. L. Tornos, J. L. Salazar, J. J. Piles, J. J. Saldana, J. Casadesus, L. Ruiz-Mas, and J. Fernández-Navajas, "An eVoting system based on ring signatures", Network Protocols and Algorithms, vol. 6, No. 2, pp. 38-54, 2014.

[32] D. Springall, T. Finkenauer, Z. Durumeric, J. Kitcat, H. Hursti, M. MacAlpine, and J. A. Halderman, "Security Analysis of the Estonian Internet Voting System", CCS'14, USA, November 2014

[33] N. H. Sultan, F. A. Barbhuiya, and N. Sarma, "PairVoting: A Secure Online Voting Scheme Using Pairing-Based Cryptography and Fuzzy Extractor", IEEE International Conference on Advanced Networks and Telecommuncations Systems, Kolkata, pp. 1–6, 2015.

[34] N. Chondros, B. Zhang, T. Zacharias, P. Diamantopoulos, S. Maneas, C. Patsonakis, A. Delis, A. Kiayias, and M. Roussopoulos, "D-DEMOS: A distributed, end-to-end verifiable, internet voting system", IEEE 36th International Conference on Distributed Computing Systems (ICDCS), Nara, pp. 711–720, 2016.

[35] P. S. Naidu and R. Kharat, "Secure authentication in online voting system using multiple image secret sharing", Communications in Computer and Information Science, vol. 625, 2016.

[36] N. L. Kshemkalyani and V. A. Bandekar, "Online voting system", International Journal of Advanced Research in Computer Engineering & Technology, vol. 5, pp. 1773-1775, June 2016.

[37] T. Habibu, K. Sharif, and S. Nicholas, "Design and implementation of electronic voting system", International Journal of Computer & Organization Trends, vol. 45, pp. 1-5, August 2017,.

[38] L. Rura, B. Issac, and M. K. Haldar, "Online voting system based on image steganography and visual cryptography", Journal of Computing and Information Technology, vol. 25, pp. 47–61, March 2017.

[39] I. E. Eteng, U. D. Ahunanya, and P. U. Umoren, "An online voting system for colleges and universities: A case study of national association of science students, University of Calabar. Computing and Information Systems Journal, vol. 22, s2018.

[40] K. Dwivedi and P. A. Mam, "Online Voting System", IJSRST, vol. 4, pp. 339 – 343, 2018.

[41] Brainpulse Technologies, "Web Development Methodology", 2020.

Njideka Mbeledogu is a Senior Lecturer at the Department of Computer Science, Nnamdi Azikiwe University, Nigeria. She holds Bachelor of Science (BSc), Master of Science (MSc) and PhD degrees in Computer Science. She is a member of the Computer Professional of Nigeria (CPN) and the Nigerian Computer Society (NCS). Her interests include Network Security, Neural Networks and Fuzzy logic

Ikechukwu Umeh holds a Bachelor of Science degree and a Master of Science degree in Computer Science. He is a member of many professional bodies such as CPN and NCS. He is currently working on the development of mobile applications for neglected populations and for the teaching and learning of certain subjects and topics. His interests include computer networks, information systems and mobile application development.
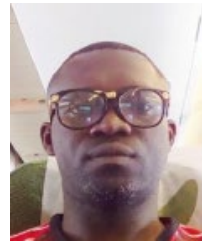
ChukwuNonso Nwokoye obtained a BSc and PhD degrees in Computer Science. He was awarded an Honorary Rosalind Member by London Journal Press. He is a two-time ACM SIGCHI Gary Marsden student award recipient. His interests include simulation and modelling of complex systems, include mobile application development, machine learning and deep learning. He is currently working on merging agent based modelling and machine/deep learning, two contemporary sub-disciplines of artificial intelligence.
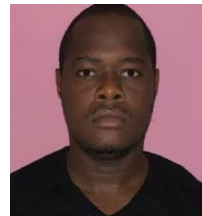
Obiajulu Ositanwosu is a Lecturer and Researcher at the Department of Computer Science, Nnamdi Azikiwe University Awka, Nigeria. His interests include Information and Communications Technology, Internet of Things (IoT), Machine Learning, Network Security and E-learning. He holds a Masters in Information Technology and His PhD research is on Internet of Things adaptability and synergy. He is a member of Nigeria Computer Society, Computer Professionals (Registration Council of Nigeria) and International Association of Computer Science and Information Technology (IACSIT).