*Jana Nexus: Journal of Humanities and Social Thought*

**ISSN(o):** Applied
**ISSN(p):** Applied
**DOI:**
**Journal Homepage:** www.jananexushst.com

*JN:JHST Volume 01 Issue 01* *November-2025, 40-48*

**RESEARCH ARTICLE**

## Paper Title

# DEVELOPING AN APPLICATION PROGRAM INTERFACE (API) FOR BOTH SINGLE AND BULK SPATIAL QUERY CAPABILITIES AND AUTOMATED VOTING IN JOS SOUTH LGA OF PLATEAU STATE, NIGERIA

**Isa Agaie Dawodu[2] and Lawrence Bunmi Adewole[1]**

1. Department of Geo-Informatics and Surveying, Faculty of Environmental Studies, University of Nigeria, Enugu Campus (UNEC).
2. Department of ICT, Federal University, Oye-Ekiti.

**Corresponding Author**: Author's Name, **Isa Agaie Dawodu**

**| ABSTRACT**

Election maleficent and the after-math of court litigatigations particularly, the 2019 and that of 2023 elections whereby, courts (which is usually at the beck-and-call of the incumbent) decides who won the ballots casted by the electorates in Nigeria; has lingered over time. The essence of this paper is to develop an Application Program Interface (API) which is user friendly with either simple or android phone for both single and bulk spatial query capabilities and automated voting using Jos South LGA of Plateau State, Nigeria as a proto-type.

**| KEYWORDS**

Wamp Server, My SQL, DBA, FGDB, RF-ID and Module

**| ARTICLE INFORMATION**

**RECEIVED:** 4 September 2025 **ACCEPTED:** 8 October 2025 **PUBLISHED:** November 2025

Election maleficent and the after-math of court litigatigations particularly, the 2019 and that of 2023 elections whereby, courts (which is usually at the beck-and-call of the incumbent) decides who won the ballots casted by the electorates in Nigeria; has lingered over time. The essence of this paper is to develop an Application Program Interface (API) which is user friendly with either simple or android phone for both single and bulk spatial query capabilities and automated voting using Jos South LGA of Plateau State, Nigeria as a proto-type. The proposed e-Voting system was designed with the goal of solving optimal challenges encountered by the traditional balloting; and some of which include precise rule-based on eligibility determination,appropriate module, robust access list creation and management as well as remote balloting. The application relies on the file geo-database obtained from National Population Commission (NPopC) but compatible with Relational Database Management System (RDBMS) on MySQL file format and the list of districts wards, localities, PUs and service area or routes to determine where each eligible voter's vote shall be tallied. This solves the distance barrier that has denied many citizens from exercising their civil rights. Age and nationality are two other major factors used by the application to determine the eligibility of voters. The relationship among various entities in the database model is either one-one or one-many in a MySQL file format. The file geo-database (FGDB) obtained was for ease of integration into the three ends of the API.The WampServer being the 'Desk-Top Server' at the back end of the app controlled by the dBA; the mid-end is between the front-end and the dBA that convey all transactions; and the front-end is exclusively for the voter. But all operations are monitored and under the control of the

database administrator (dBA). Each of this end is being managed by specific module interactively and seamlessly and robust enough to carry all election stakeholders along in election transactions before, during and after the election results are displayed with the RF-ID of the dBase, whicgh is managed by the third party as it is done in other ckients.

## 1. Introduction:-

The dilemma of Nigeria's election and the quest for effective system of voting, policy makers in the country begin to advocate for e-voting as an alternative to the traditional ballot system that lacks transparency, loss of confidence and trust in electoral process; and other electoral related issues that characterized the voting system in the country [1, 3, 4].

Prior to the 2015 general election in Nigeria, the then chairman of Nigeria's Election Management Body (EMB), Prof. Attahiru Jega introduced 'Card Reader Machine' technology for validating the bio-metric data of an eligible voter on Election Day before casting ballot [5, 6, 10]. Unfortunately, it was frustrated on 'Election Day', it could not authenticate the finger print of the incumbent President Goodluck E. Jonathan [7]. There was the issue of latency in matching the finger print with the facial.
The quest to make Nigeria election more credible and transparent made the INEC introduce the BIVAS technology which has been around for some time, it was first tested in the Isoko South Constituency 'Bye-Election' in Delta State, Sept $10^{TH}$, 2021, $10^{TH}$ Feb, 2023 [9]. But, the BVAS was meant to perform three functions namely; bio-metric accreditation of voters before ballot, to snap the polling unit result sheet (form EC-8A) after collation and duely signed by all polling agents; then transmit such result to INEC result portal (IREV) [[10].

But, in the 2023 Presidential and National Assembly elections, the BIVAS that could not transmit the presidential election result to the IREV was able to transmit that of the Assembly election results from the same polling unit [9, 5]. What an irony! INEC's says, there was a 'Technical Glitch' at the point of transmitting the Presidential result to the IREV portal, as it was reported on one of the popular electronic media [6, 5]. It is against the background of the aforementioned that this paper seeks to develop an application that shall interface for small and bulk query capabilities and automated voting [5] for both single and bulk users; and the app be protected with anti-spoofing from would be hackers.

**2. Related work**

It is pertinent therefore, to introduce the conceptual framework for the app; the anticipated e-Voting system was designed with the goal of solving optimal challenges faced by the traditional approach to balloting [4, 5, 6]. This include a precise rule-based on eligibility determination module, robust access list creation and management, as well as remote balloting [5]. The application relies on a database with the list of states, their local governments, districts and Wards to determine where each eligible voter's vote shall be tallied [7]. This solves the distance barrier that has denied many citizens from exercising their civil rights. Age and nationality are two other major factors used by the application to determine the eligibility of voters [9]. The relationship among various entities in the database model is either one-one or one-many [11]. For Nigerians in the diaspora wanting to vote during election Nigerians outside the country can still vote, only if they have a Nigeria address and or fly home to cast their ballot [13], which most people cannot afford. The Abuja based Nigerians in Diaspora Commission says further that; Nigerians abroad sent more than 20 billion dollars back home in 2021, the highest in sub-sahara Africa in 2023 [13]. It is justifiable therefore to allow them vote seamlessly since their yearly remittances is significant enough to positively affect the country's gross domestic product (GDP). The former INEC boss Prof. Attahiru Jega in the aftermath of the 2023 elections says, the pundits are afraid of technology, because it will bring sanity in the entire election processes [[10]. However, the technology is not without challenges; but investigations revealed that, majority of the problems are man-made.

## 3. Material and Method:-

### 3.1. Material

The material required to prosecute the objective of this article was obtained from the file geo-database of the National Population Commission (NPopC), which is compatible to MySQL file format for ease of integration into file geo-database of ArcGIS and dis-aggregated into needed different data-types and attributes (data structure) for analysis. Then the geo-coded residential addressess of all eligible voters be also integrated into the file geo-database. Table 1 below is a sample of material obtained from the NPopC.

**Table 1. dBase Sample**.

| Nationality | State_Name | State_Code | LGA_Name | LGA_Code | Loc_Name | Loc_Code | IRA_Name | Bldg_Code | IRA_Code | PU_Code | Pop_Loc | Gender | Age | B_C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawan 'A' | 1601 | 11 | 1 | 6753 | M | 19 | Y |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawan 'A' | 1602 | 11 | 1 | 6753 | M | 23 | Y |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawan 'A' | 1603 | 11 | 1 | 6753 | M | 30 | Y |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawan 'A' | 1604 | 11 | 1 | 6753 | M | 27 | Y |
| 1 | Plteau | 23 | Jos | 73 | Fwati | 10 | Zawa | 1605 | 11 | 1 | 6753 | F | 4 | Y |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | South | | | | n 'A' | | | | | | 3 | |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawa n 'A' | 1606 | 11 | 1 | 6753 | F | 40 | Y |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawa n 'A' | 1607 | 11 | 1 | 6753 | F | 39 | N |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawa n 'A' | 1608 | 11 | 1 | 6753 | F | 54 | N |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawa n 'A' | 1609 | 11 | 1 | 6753 | F | 58 | |
| 1 | Plteau | 23 | Jos South | 73 | Fwati | 10 | Zawa n 'A' | 1610 | 11 | 1 | 6753 | F | 47 | Y |
| 1 | | 23 | Jos South | 73 | Fwati | 10 | Zawa n 'A' | 1611 | 11 | 1 | 6753 | F | 41 | Y |

Source:National Population Commission (NPopC) Abuja, (2024).

### 3.2. **Method:-**

The following steps were taken in order to develop the API for both single and bulk spatial query capabilities and automated voting in Jos South LGA of Plateau Stae; Step 1: Application ConfigurationAssigning a voter to a specific voting or polling unit, require an application program interface with three different ends namely; the front, mid and the back end respectively. The front end was developed using HTML, JavaScript, and CSS. HTML were used in order to assist in quickly separating marked texts from un-marked texts, and for ease of sorting and validating a voter before voting; while CSS separates contents like layout colors, fronts and improve control over the contents when matching voter's photograph with the finger print before voting; and the JQuery is the module that allows for voter's interactions at the front end seamlessly. Some elements of JQuery were added to make the application more interactive and user-friendly. The front-end is the interface which allow qualified citizen register and also permit registered voters to perform their civic right in a designated polling or voting point. It also allow the application administrator to create various configurations, schedule elections and also generate various reports; such as voters register of all eligible voter, their district, voting point (polling unit) and location; in terms of locality name, etc. Figure 1 below shows the internal structure of the database model:

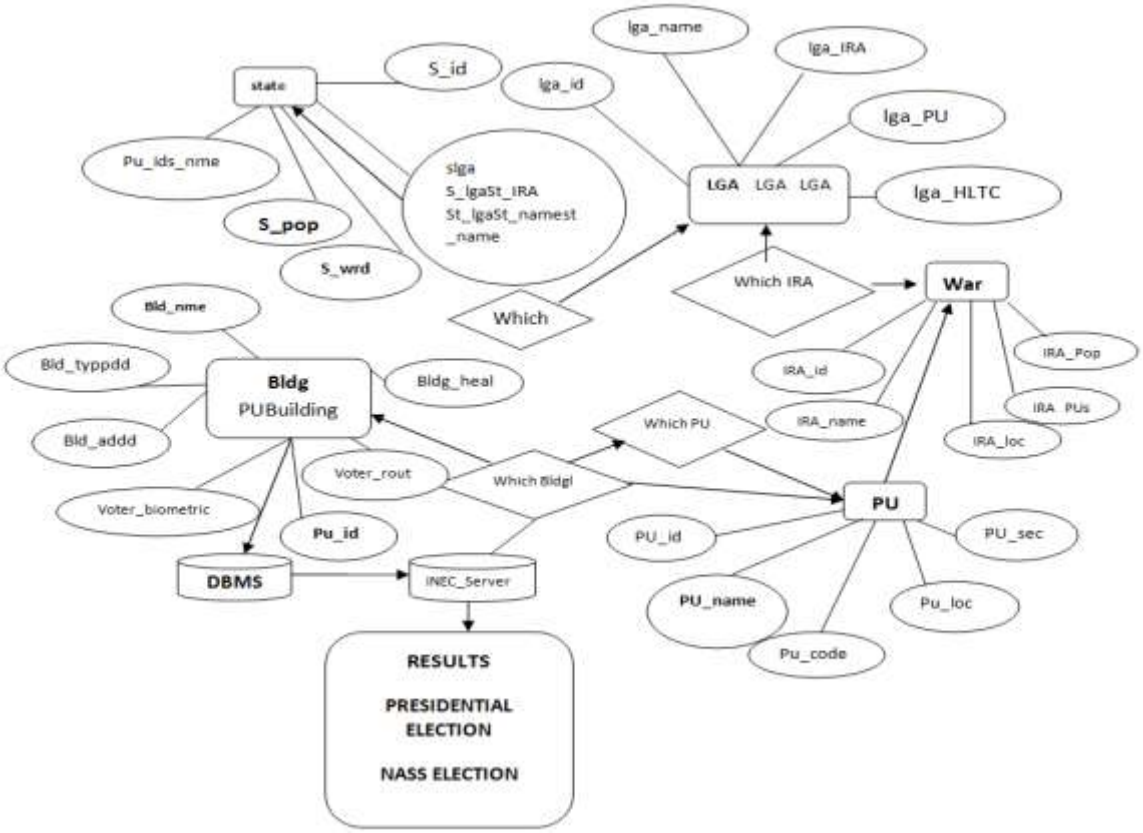


Figure 1. Mental Abstraction of the Apps Database.

**Source: Author's Field Work (2024)**

**Step 2: Module to Convert Geo-database File to CSV format**

In order to integrate file geo-database model of table 1 above which was in excel file format, it was subsequently converted to CSV file format. This format fits easily into MySQL language used in developing the application (app.). The biometric capturing and matching module involve high computational cost of image template matching which require high end server; as such the anticipated application program shall only explain how the module works.

**Step 3-Entity Relationship**

The figure below is the schema of the implicit interactions of different layers of election data collected and analyzed at the back-end of the app. The relationships were all defined and their attributes.

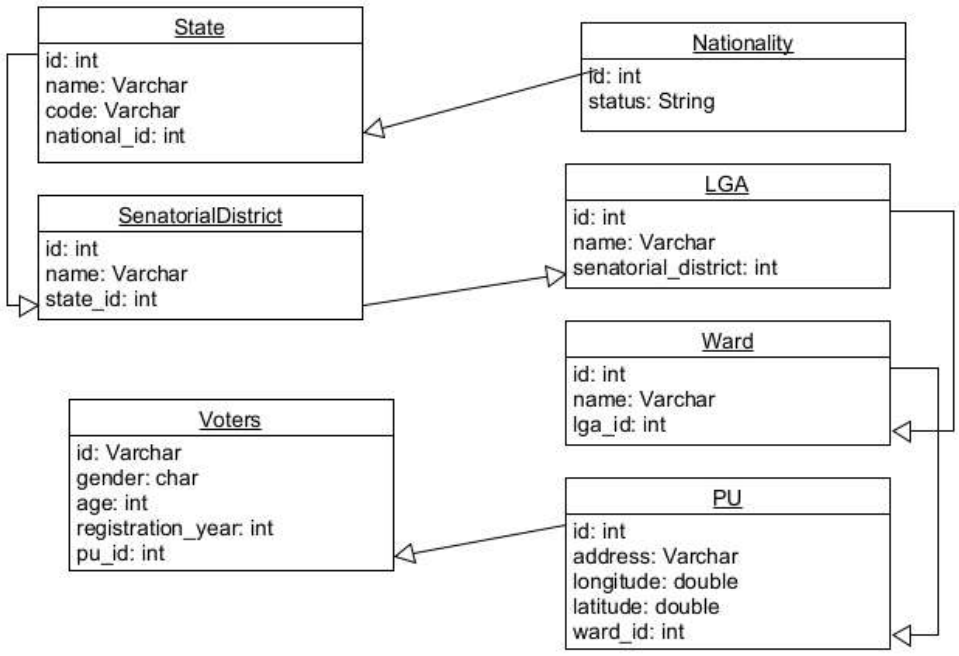


**Figure 2. Entity-relationship (E-R) diagram for voters 'registration.**

**Source: Author's Field Work (2024)**

For each election into various office, the administrator (dBA) creates both setup and schedule. The setup process involves the definition of political parties contesting an election, the post being contested, and the association of such post to either national, state, senatorial district, local government area, or ward. The database model for an electoral setup is as delineated in figure 3 below. This model supported and serve as interface between the database structure (E_R) schema and the voter.

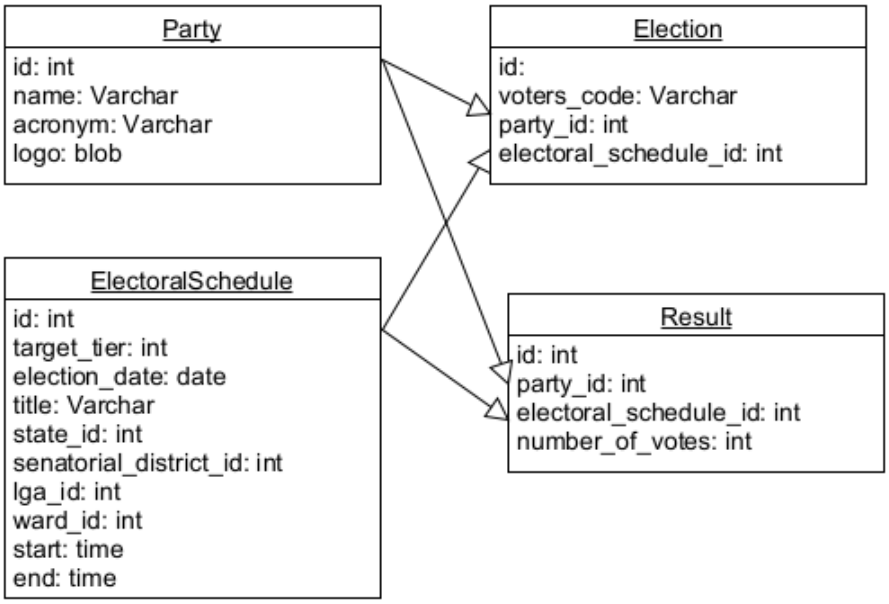


**Figure 2. Interface between dBA and the Voter**

**Source: Author's Field Work (2024)**

## 4. Results and Discussions:-

Output 1: Entry Point to the app

Figure 5 below is the screen-shot of the main entry point to the app from the dBA Admin (code=admin). The dBA admin signs into the app using 'admin' as user name and any two or three digit numeric code (1 2 3). This shall take the operator to the 'super admin' phase. See figure 6 below:

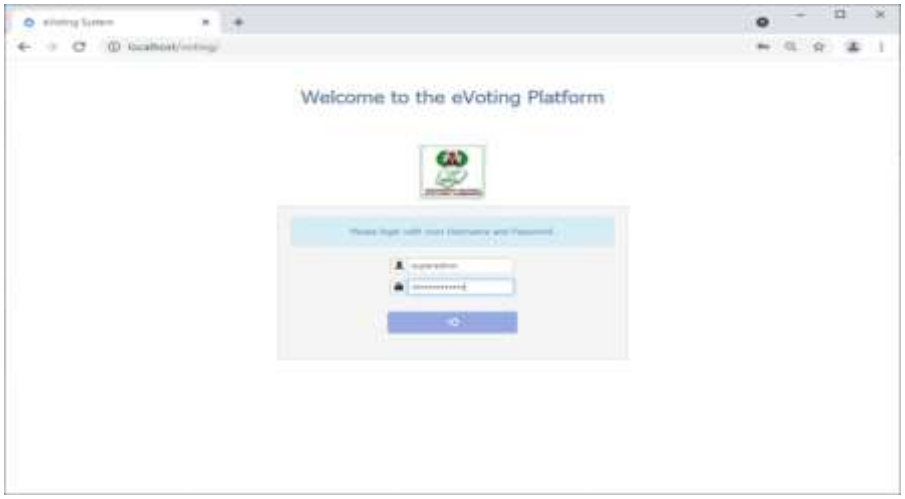


**Figure 3. Super Admin phase (dBA)**
**Source: Author's Field Work (2024).**

**Output 2:Voter's Registration**

Before an eligible voter is assigned or have a designated voting point or polling unit nearest to his or her residence, such person must be captured in the voting program designed, all the biometric capture, residential address, nationality, state, LGA, name and other relevant data. The voter's registration page provides an interface through which eligible citizens' details are captured and stored in the system. This include the surname, first name, middle name, date of birth, gender, phone number, state of origin, senatorial district, local government area, and ward. To make entry easier, a relation has been defined such that for any given ward code, the name of the ward, the local government where it is located, the senatorial district, and the state, can easily be retrieved. Each registration officer is assigned a particular ward. Hence, by default, any voter registered by such registration officer is added to the list of eligible voters for the ward. See Figure 7 below;

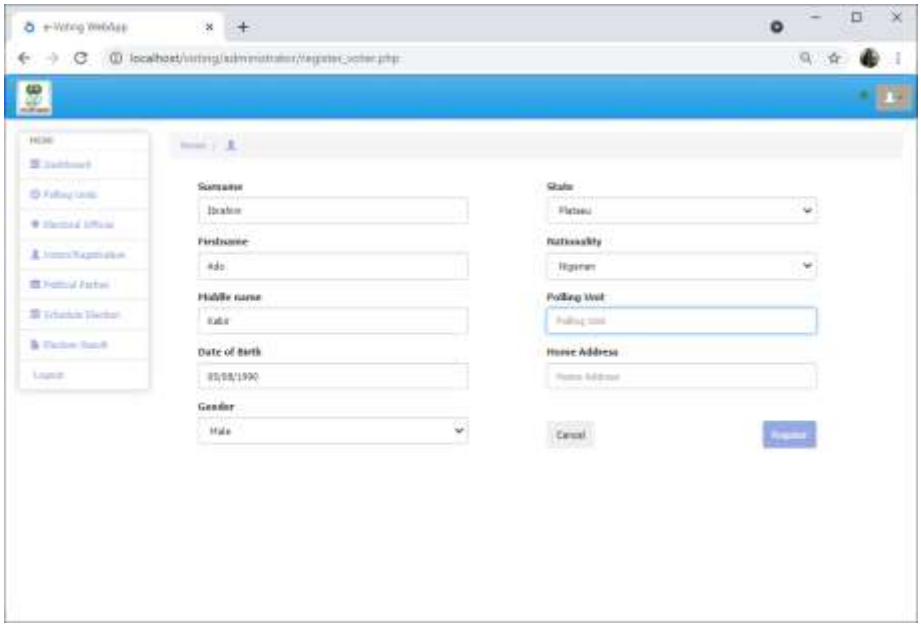

**Figure 4. Voter's Registration Module**
**Source: Author's Field Work, (2024).**

**Output 3: Procedure for Voter Verification and Vote Casting**
The process is initiated when the electorate presents themselves for verification. The basic assumption is that the Polling unit that the voter approaches was designated and for verification and also have internet facility for real time verification. The verification exercise follows thetradition verification process in which the voter's card and fingerprint are matched with the database of eligible voters. In order to reduce the latency, template matching is limited to users within the polling unit of the voter since the residential address was geo-coded. If the verification process is successful, the voter can then proceed to the voting interface with a unique code generated by the server.

The web content was specified using HTML while the application layout was structured using CSS. The web template used is responsive thereby allowing easy access of the application from hand-held devices such as mobile phone and custom displays. See sample of the database in Table 8,1. Usually, the application was pre-loaded with data and information obtained from the file geo-database of ArcGIS; then filtered by HTML and CSS before use. The data forms the basis for registration of voters and validation, election schedules, and collation of election results.

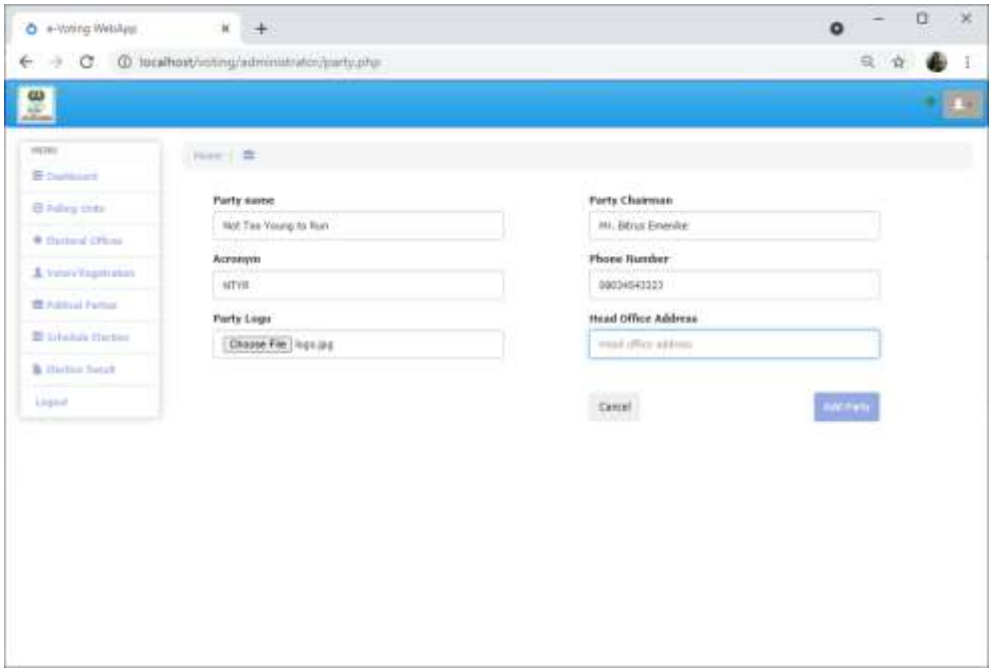


**Figure 5. New Party Registration Platform**
**Source: Author's Field Work, (2024)..**

**Output 5: Election Schedule**
After successful registration of voters and political parties, the administrator can then proceed to schedule an election. The process of scheduling an election involves the definition of the Offices involved in the election, for example, in a Presidential and Senatorial election. The administrator can then specify the targeted audience which could be one or more wards, one or more LGAs, one or more senatorial districts, one or more states, or the entire nation. The flexibility factored into the design at the phase is to ensure that the proposed framework is relevant for conducting general elections, state-bound elections, and even re-run elections that are to be carried out at selected polling units.The scheduling process involves the specification of the office (e.g. Presidential), the list of ward where the election will be carried out, the scheduled date, start time, end time and schedule status. For elections that are cancelled or postponed, the status is set to -1, 0 for schedules that yet to start and 1 for schedules that have been conducted See screen-shot of the platform:

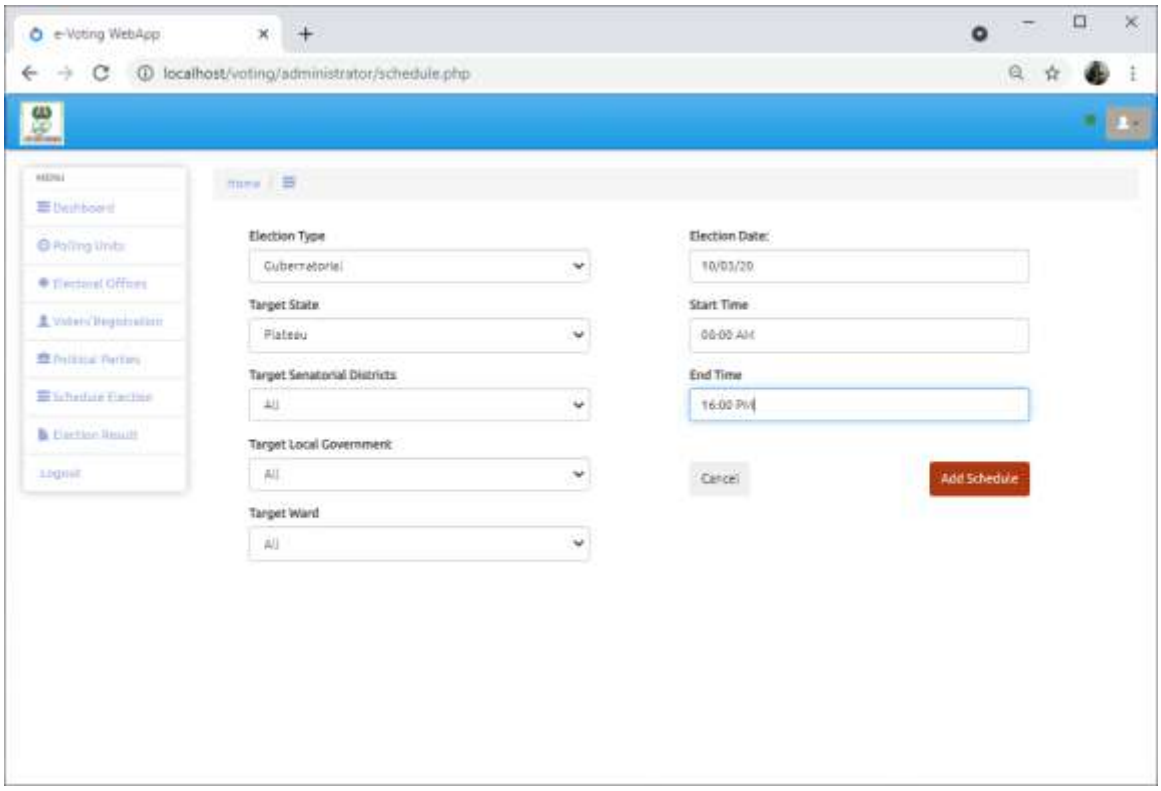


**Figure 6. Election Operator's Platform.**
**Source: Author's Field Work, (2024).**

**Output 6: Vote Casting**

The process is initiated when the electorate presents themselves for verification. The basic assumption is that the Polling unit that the voter approaches for verification has internet facility for real time verification. The verification exercise follows the existing tradition verification process in which the voter's card and fingerprint are matched with the database of eligible voters. In order to reduce the latency, template matching is limited to users within the polling unit of the voter. If the verification process is successful, the voter can then proceed to the voting interface with a unique code generated by the server. In this research, a simple web interface has been developed. This can be extended to mobile application, with support for multiple platforms, and specially built handheld devices. The voting platform accepts as input the user's voters' ID and a unique code generated from the server during verification. As an additional layer of security, a two-factor authentication scheme has been incorporated into the design. Once the voters' ID and unique code has been verified, the application generates and sends a PIN to the phone number associated with the voter's detail, to mitigate the possibility of Voters' card theft. The generated PIN is then used for the 2FA. After successful verification and authentication, the application displays the list of concurrent elections, if more than one election is on-going. User can click on the choice post and a list of political parties, having aspirants for such post, is displayed. After the voter's choice has been made, the browser transmits it to a central server where the results are being collated in real time. Communication between the client and the server are encrypted using a symmetric cipher where the user's password is the key used for both encryption and decryption at both ends. After the completion of the electoral process, the electoral officer can end the election before the end-time, provided that there is no more electorate to vote. Result of an election is made available immediately after the election has been closed for each polling unit while the aggregate result is updated as new results are computed for completed elections.

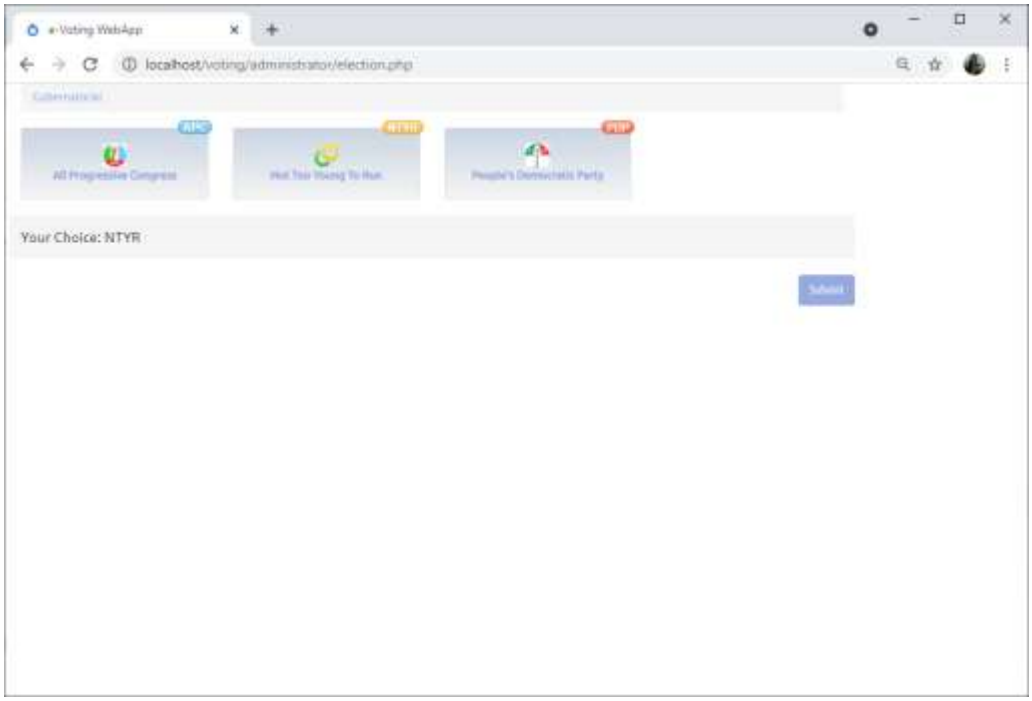


**Figure 7. Front End Platform**
**Source: Author's Field Work, (2024).**

## 5. Conclusion:-

In the nutshell, the developed app for small and bulk spatial query capabilitirs and automated voting system was as shown in figure 11 below, its nternal operations. The app was configured for simple phone not necessarily android but it can be used on Election Day to vote, once a network is available as gate-way.

INEC at the LGA level initiallymay not require internet service to register eligible voters since the WampServer is mobile. But, during election proper, an internet service would be needed. Therefore, the app is expected to reduce to a bearest minimum different types of electoral maleficent, since the number of human operators are reduced drastically. It is also cost effectiveand all stakeholders are involved in the election process.

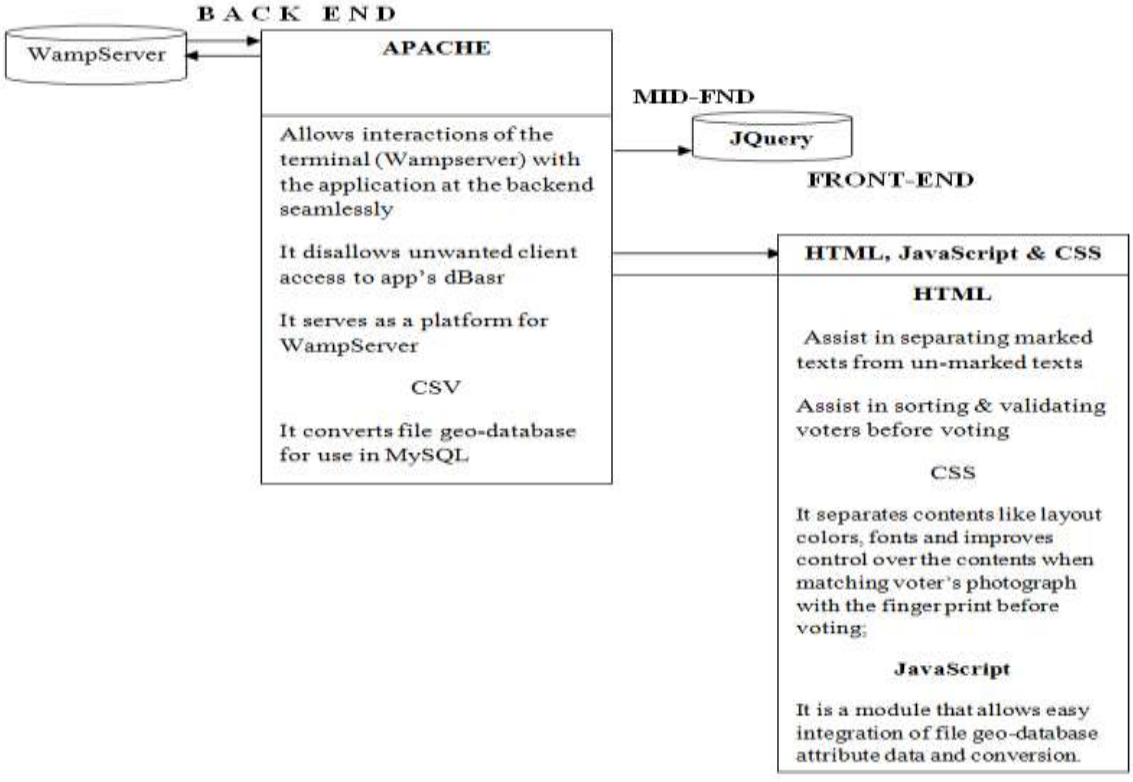


**Figure 8: The app's Internal Architecture.**
**Source: Author's Field Work (2024).**

**NOTE**
The RF-ID of this application can best be protected by submitting the entire dBase to a third party proprietor whose main responbility is to protect and preserve the integrity and sanctity of the data in the dBase from the would be hackers as it is done in other clients.

**Abbreviations**
RF-ID:Referential Identification
RDBMS: Relational Database Management System
HTML: Hyper Text Mark-up Language

## Acknowledgments:-

I remain grateful to Dr Lawrence, Bunmi A. a Lecturer with the Federal University, Oye-Ekiti in Ekiti state, Nigeria; and a specialist in Arttificial Intelligence (AI) who designed and installed the app for this study. More grease to your elbows.
I deeply appreciate the immense contribution of Dr. Sanjo, Fashola (AI Expert) who took his time to understand the purpose of this study and paid Dr. Lawrence to design the app.

**Conflicts of Interest**
No conflict of interest of any kind from any Author.

## References:-

[1] Abu-Shanab, E., Knight, M., & Refai, H. (2010). E-voting systems: A tool for e-democracy. Management Research and Practice, 2, 264-274.
[2] Adamo, Tuesday David (1979): Religion and Elections in Nigeria: A Historical Perspectivehttps://orcid.org/0000-0001-8610-4289 University of South Africa
[3] Adebowale, S. (2014, January 30). Diaspora voting not feasible in 2015 – INEC. Retrieved from http://theeagleonline.com.ng/diaspora-voting-feasible-2015-inec/
[4] Ajayi, G. O. (2003). NITDA and ICT in Nigeria. Paper presented at round table on developing countries access to scientific knowledge. The Abdus Salam ICTP, Trieste, Italy.
[5] Bellis, M. (2011):The History of Voting Machines.www.about.com. Retrieved 11th July, 2012.Buchsbaum, T. (2004): "E-voting: International developments and lessons learnt". in Informatics. Workshop of the ESF TED Programme together with GI and OCG.
[6] Channels TV, (2023): Chart with YIAGA Africa Director (Samson Itodo) on the 'Technical Glitch' while transmitting 2023 election results to INEC result viewing portal.
[7] EAD (2015): National Population Commission, 2015 Enumeration Area Demarcation (EAD) file geo-database for the 774 Local Government Areas of Nigeria
[8] EU-Election Observer (202015): European Union Election Observer Mission to Nigeria on Smart Card Reader and the 2015 Election
[9] Dattes, C.J (2000): Database Management System (DBMS) University of South Africa adamodt@gmail.com
[10] Europian Union (EU) Election Observer (2023): Report on 2023 Nigeria's election. 'Elections held on schedule, but lack of transparency and operational failures reduced trust in the process and challenged the right to vote'
[11] Isa Agaie Dawodu (2024): Developing a Unique Identifier of Smallest Possible Ballot Area that Create One-one-match with Voting Unit Identifier for Efficient Election Management in Jos South LGA Plateau State, Nigeria
[12] Sabo Ahmad, et al (2019): Issues and Challenges of Transition to e-Voting Technology in Nigeria; May 2019.
[13] VOA (2023):Nigeria Court Dismises Lawsuit to Allow Diaspora Voting, Feb 20th 2023.