

Development of Biometrics Controlled e-Voting System

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ABSTRACT

Voting is a universal activity in majority of countries of the world; unfortunately, they are marred with problems of integrity, violence, manipulation, ballot stolen, and many more. Information and communication technology (ICT) provides many means of combating most figured out challenges to make things better. This research titled Biometrics Controlled e-Voting System is one of the measures to counter all these odds. Current system of voting was examined in two ways, manual and computerized ones. Pros and cons of these systems were carefully studied while new procedure of voting was developed. This one is a paperless system that uses finger print to allow voters to have access to parties to vote for. Algorithm was developed and coded using Microsoft Visual Studio having Admin and Voting modules. Registration using finger print helps in making the task easier as only registered voters will be allowed to vote. The system automatically uploads voters, allows only registered voters to vote, deny non –registered voters, calculate votes after voting per party automatically and does not require much training for illiterate voters using touch screen systems. Soft and hard copies of the result can be produced and given to party agents at every pollen unit. This implies that, implementation of this research will bring transparency, accuracy, and timeliness while forgery, tuggery, violence, ballot stolen, and manipulation of results will be eradicated.

Keywords: Algorithm, Biometrics, Voting, Transparency, Software

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1. INTRODUCTION

The importance of election in a democratic government cannot be overemphasized. This is because it is the only means by which the electorate decide those who would hold position of authority. Over the years, it has become evident that nations that successfully conduct free and fair elections are judged to be civilized and developed. In developing country, elections are carried out manually. This however leads to problems such as lack of transparency, poor handling of election process by stakeholders, inability to protect the secrecy of the vote casted, unsecured voters' authentication and use of hooligans. In a bid to overcome such challenges, e-voting came into limelight. e-Voting has defined by Krimmer, Triessnig, & Volkamer (2007) is the use of electronic means such as phones, Personal Data Assistants (PDA), personal computers and internet for at least the casting of the vote. e-voting is generally acceptable because of its ability to provide better accessibility to voters, ensure rapid implementation of elections, guarantee efficient use of resources and facilitation of direct democracy by fraud prevention (Krimmer et al., 2007). Despite its acceptability, countries that have employed its use is insignificant. Fig. 1 depicts an annotated map to support the above claim. From the figure, it is clear that Nigeria is not one of the countries that have used e-Voting. Therefore, this study is geared towards developing a system that can be efficiently used in Nigeria for conducting free and fair election devoid of crisis.



Fig. 1 Use of e-Voting Globally (Krimmer et al., 2007)

Moreover, in order to guarantee the actualization of its benefits, biometric authentication needs to be incorporated in order to ensure that an effective method for automatically recognizing, with a high confidence, a person's identity is put in place. Biometrics is a method of recognizing a person based on physical or behavioural characteristics. Examples of biometric information used to identify people include fingerprint, voice, face, iris, handwriting, and hand geometry. One method of identification is "one-to-many" (1:N) matching process in which a biometric sample is compared sequentially to a set of stored samples to determine the closest match. The other type is verification which is a "one-to-one" (1:1) matching process in which the biometric system checks previously enrolled data for a specific user. The verification method provides the best combination of speed and security, especially where multiple users are concerned, and requires a user ID or other identifier for direct matching.

Human fingerprints are unique to each person and can be regarded as a sort of signature, certifying the person's identity. Fingerprints are the oldest and most widely used form of biometric identification. A fingerprint is formed from an impression of pattern of ridges on a finger. As a result, this paper focuses on the fingerprint biometrics to control the e-voting system.

Therefore, the aim of this research is to develop a paperless (computerized) biometrics controlled e-voting system with specific objectives of gathering requirements and analysis on different system of voting. In addition, the study involved development of algorithms for different modules of the software. This was followed by coding of the system using Microsoft Visual Basic Studio version 2005. This will ensure there is a database for voter's registration which will store voter's information, an interface which inputs the voter's fingerprint and outputs his/her details and lastly a platform for casting of votes and also collation of the results. This will make voting easier, paperless, free and fair without security threat from any angle since it does not require any human intervention from the beginning to the end of voting.

2. MATERIALS AND METHODS

The Biometric controlled e-Voting system has Graphical User Interface (GUI) and database. Software tools used are Microsoft Visual Studio 2005 for front end (GUI), debugging, coding, testing and running while MS-Access was used for backend since registration per pollen unit cannot be more than few thousands. UML was also used for use case, flowchart and block diagram.

2.1 Methodology

Voting techniques through manual where ballot papers are used was examined and found replaceable electronically without paper and indelible ink. Experimentally, all party flags are to be shown while option button that doesn't allow two options is used. Registration list and fingerprint scanner that is being used by INEC currently to authenticate names of registered voters is also replaceable with fingerprint scanner that will show authentic registered voter. In addition, a paperless single system will replace all.

2.2 Algorithm

Algorithm helps software developer tremendously as it gives room for steps to follow in coding in any language of your choice. It gives vivid idea to be able to achieve the target goal of the system. The algorithm below clearly shows how biometrics can be used to have paperless voting system. It controls everything. It does not require voters list, ballot paper, and manual counting in all pollen units.

Sample Pseudo-code for Biometrics Controlled e-Voting System

```

→ Start
    → Scan Finger for recognition
        → Check if already Store in the system (i.e. from the Captured voters Database)
    → If found
        → Display voters personal data
        → Activate voting module
    → Check if already voted
        → Then reject and display already voted (No room for double voting)
    → Else if not voted before
        → Allow to vote
    → Else Voter not found
        Display not registered voter
→ Stop
    
```

Other algorithms for other areas are not as important as the one above that controls the actual voting while many other researchers (Abandah, Darabkh, Ammari, & Qunsul, 2014; Alimi, Adagunodo, & Gambo, 2009; Esteve, Goldsmith, & Turner, 2012; Robert Krimmer, Ehringfeld, & Traxl, 2010) have developed algorithm on voters' registration, calculation, and so on. Despite that, the coding below handled all other aspect of registration with avoidance of double registration, party registration, candidate registration, counting, and generation of reports.

2.3 Coding

Eight modules were developed; among them are welcome form, menu form, voting form, admin menu, candidate registration form, voters' registration form, election category form (Presidency, Governorship, Senate, House of Rep, LG Chairmanship, and Chancellorship) and result form. The backend used was MS Access with encryption to secure the data from unauthorized access. MS-SLQ Server is expected to be used if more users are expected.

Visual Studio 2005 was used to develop the code. The pertinent module in the system are

- a) Registration process module (fingerprint capture and Bio data)
- b) Ballot module
- c) Voting module
- d) Live Result Module

a) Registration Module

This module is for the voter, where he/she must first register his/her details first into the registration form, fulfilling all the required specifications. The required fields are; First name (CHAR), Middle name (CHAR), Surname (CHAR), Sex (BOOLEAN), Date of birth (DATE), Phone numbers (INT), Local government (VARCHAR), State of origin (CHAR), Occupation (VARCHAR), Local government to be registered (CHAR), User name (CHAR) Confirm username (CHAR), Email (VARCHAR), Address (CHAR), Picture upload (jpg, gif, bitmap and maximum size of 5MB) and Scan his/her finger using the fingerprint scanner. If the validations are valid then only the information gets registered. Once the voter gets registered he/she is registered on the database.

b) Party Update Module

This feature is provided for the administrator, where ballot can be setup i.e. inserting candidate names into the ballot for respective categories (electoral position). The administrator can also update any candidates' profile or information by either editing or deleting information for respective categories of the election. After editing the setup, the administrator can post the ballot for voting.

c) Voting Module

This module is for the voters, where votes are casted. After the voter has registered, his/her bio-data will be saved in the database including the fingerprint details. During the voting on the voting page or interface, voters are required to scan their finger on the fingerprint scanner for authenticity of the voter. Once found, his/her biodata and picture will appear. Afterward, the voting interface will then be activated and the voter can now cast his/her vote. For instance, President and Federal House of assembly. A voter cannot go back to the page to cast a vote again as system will automatically deny such voter. A voter cannot go back to the page to cast a vote again.

d) Live Result Module

This module is developed for the final result where the result of the prospective categories after the whole vote has been casted. The Administrator can then print the final result in the presence of the party agents and gives each party agent copies of the result.

2.4 Requirement Gathering of the System

Requirements' gathering is an important step towards building systems that satisfy users' requirements as well as business goal (Bennett, McRobb, & Farmer, 2010). For this type of research, interviewing domain experts, background reading as well as document sampling provides in depth information about the domain knowledge (Salau-Ibrahim & Abdulsalam, 2016). After thorough analysis, the logic of the voters' registration and the voting process were modelled as flowchart in fig.2. In addition, the requirements of the system from the users' view point was modelled as use case diagram depicted in Fig. 3.

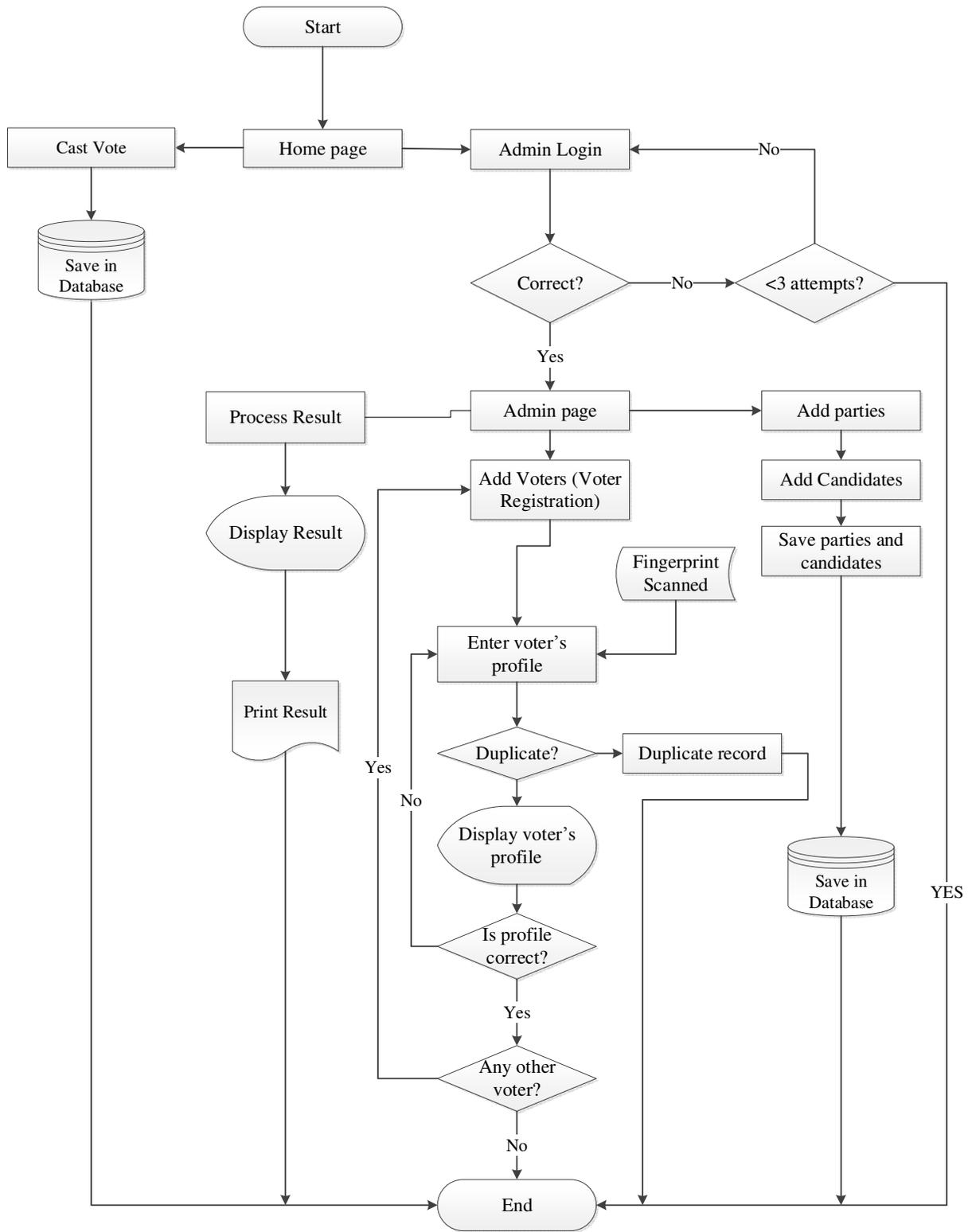


Fig. 2: Process Flowchart for the e-Voting System

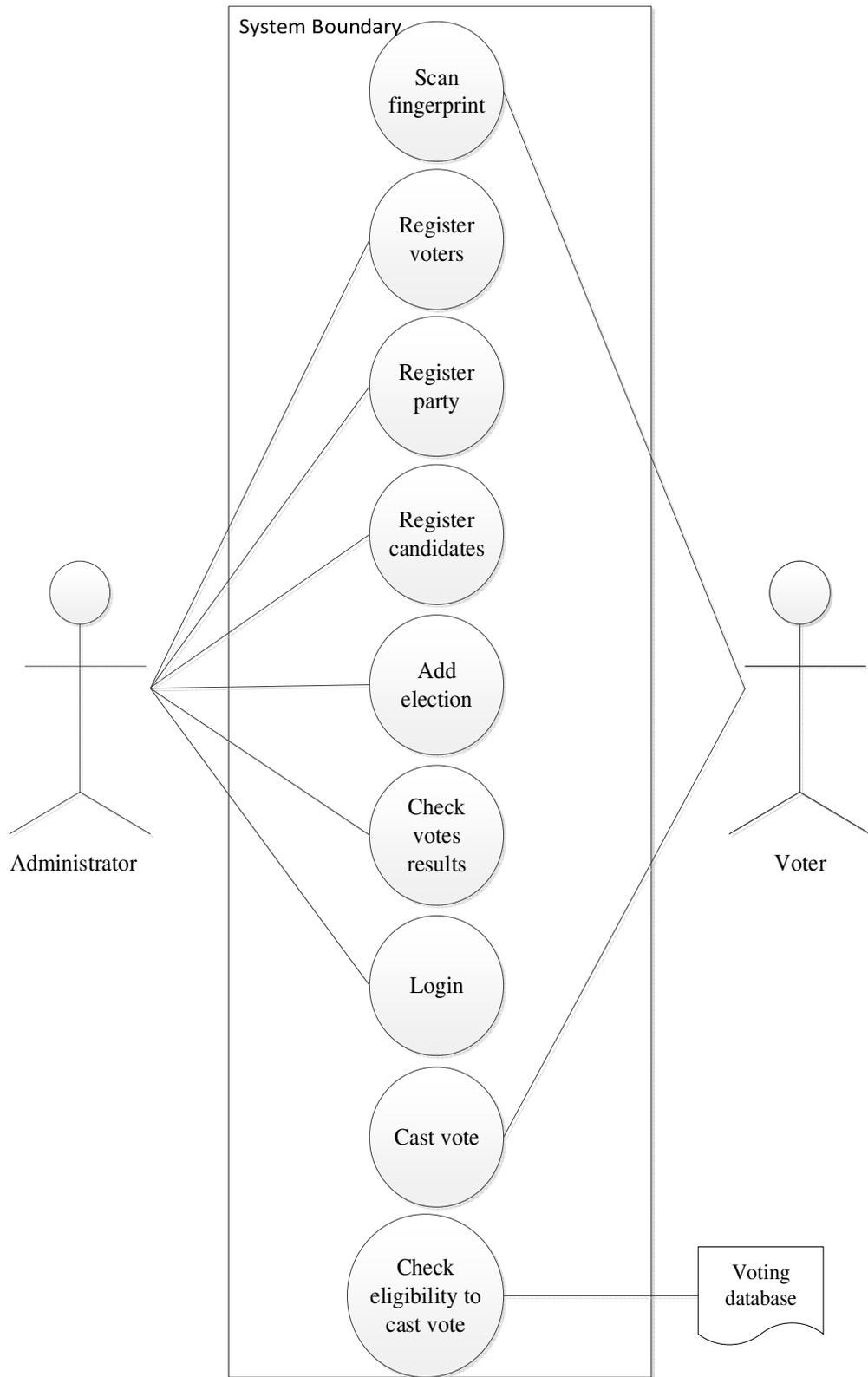


Fig. 3: Use Case Diagram for the e-Voting System

3. RESULTS AND DISCUSSION

After coding, it was evident that the system can conveniently alleviate the problems associated with manual voting and current e-voting system. Below are screenshots of the forms that would be used for interacting with the system.

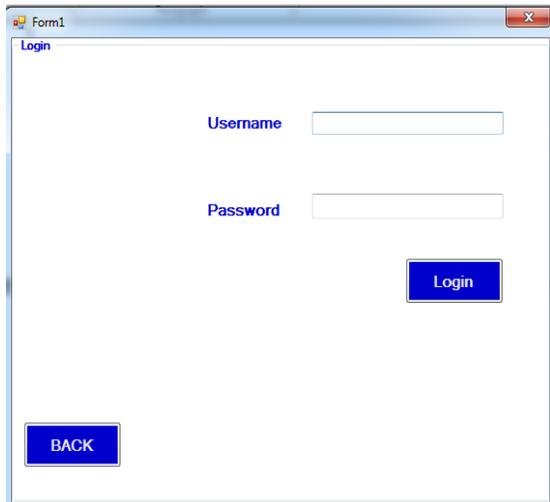


Fig. 4: Login Form

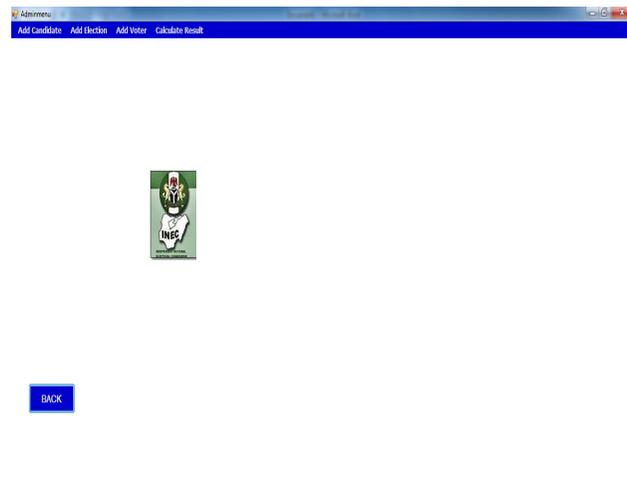


Fig. 5: Administrator Menu

Login Menu: This is where a registered administrator would login with a username and password to perform administrative task. After successful login, the admin is redirected to the admin menu as shown in Fig. 4.

Admin Menu: In the admin menu, the administrator can register voters, add candidates and check the results of any election as shown in Fig. 5.

Add Candidate Form: this form is used by the administrator to add candidates based on party and shown in fig. 6.



Fig.6: Add candidate form

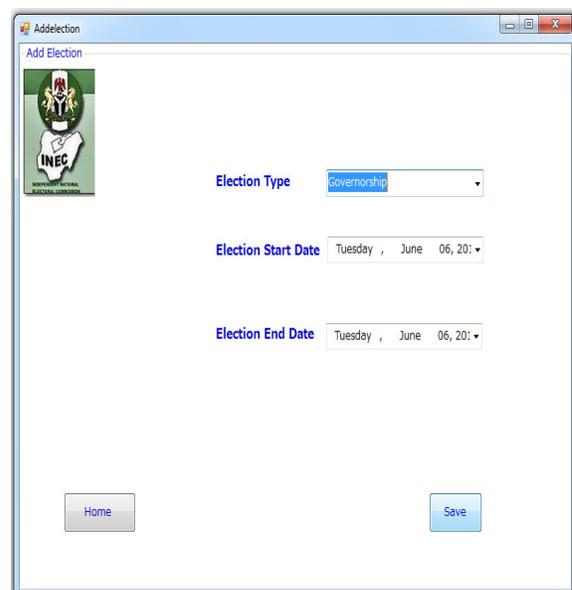


Fig.7: Add Election form

Add Election Menu: this form is used for adding a specific type of election to be conducted. The start date as well as the expected end date of the election are also specified.

Registration Menu: this menu depicted in Fig. 8 the prospective voters register in order to eligible for casting vote in the election. The fingerprint of each voter is captured at this point and stored in the database for voting purpose. The passport photograph of the prospective voter is also uploaded and saved for better integrity and trust in the election process.



Fig. 8: Voters registration form

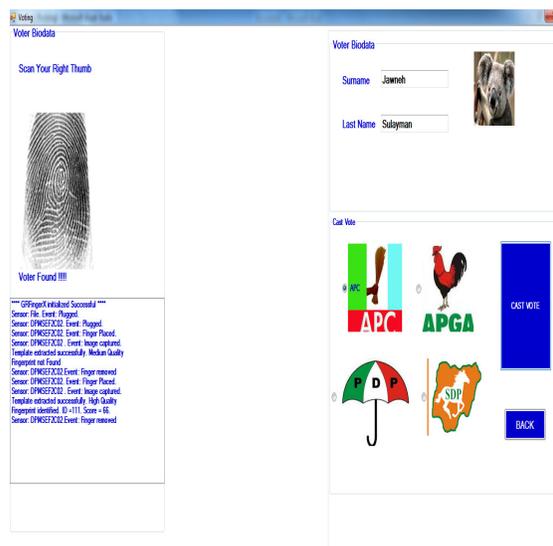


Fig. 9: Voting form

Voting Menu: On the voting interface, a registered voter would place his/her right thumb on the fingerprint scanner which would scan the fingerprint and call the voter's detail from its location in the database. Once voter's information has been called, it is displayed on the screen and voting is activated. Voter can now select party and save vote once. In a case where a voter tries to vote more than once, it would not be saved. This form for the voting id depicted in Fig. 9.

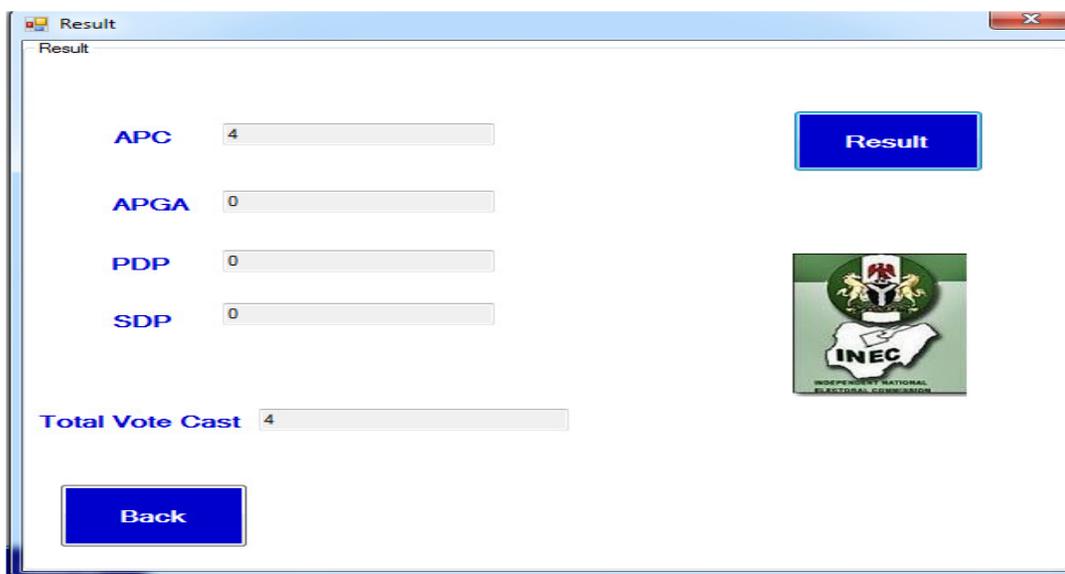


Fig.10: Voting Result Display Form

Results Menu: This form is used for displaying the results of the voting. It shows the number of votes for each of the parties.

4. CONCLUSION AND RECOMMENDATION

Conducting election is an important aspect of governance; for the reality is that the electorate needs to make good decision about those that would handle the affairs of the country. The use of IT in every aspect of life including government in order to increase the speed of processes and increase efficiency and reduction of human intervention is a thriving area of research. Specifically, IT use in electioneering in order to ensure transparency, trust, and secured voting system Therefore, this work is focused on saving time and energy as well as increasing efficiency in relation to conducting free and fair election. In this study, the basic concepts of conducting election as well as the fundamentals of biometric authentication were fully understood. From this knowledge, a biometric controlled system was then developed for voting. This work is highly recommended for the government of Nigeria as well as any establishment that needs to elect members into position of authority. This claim can be supported with the work of (Abu-Shanab, Knight, & Refai, 2010) in which the adoption of e-voting was proposed for students' election in the university system. Therefore, this can also be adopted in Nigerian Universities. Further research should look at making biometrics controlled e-voting system, a web based application that could have a central data base with big data management in consideration and central control of voting system.

REFERENCES

- Abandah, G. A., Darabkh, K. A., Ammari, T., & Qunsul, O. (2014). Secure National Electronic Voting System. *Journal of Information Science and Engineering*, 30(5), 1339–1364.
- Abu-Shanab, E., Knight, M., & Refai, H. (2010). E-voting systems: a tool for e-democracy. *Management Research and Practice*, 2(2), 264–275.
- Alimi, O. ., Adagunodo, E. R., & Gambo, I. P. (2009). Cleanroom Electoral Software Engineering Approach as a means of Reliable E-Voting System. In *International Conference Proceedings of Nigeria Computer Society* (pp. 297–302).
- Bennett, S., McRobb, S., & Farmer, R. (2010). *Object-Oriented Systems Analysis and Design using UML* (4th ed.). McGraw-Hill Education.
- Esteve, J. I., Goldsmith, B., & Turner, J. (2012). International Experience with E-Voting. *International Foundation for Electoral Systems*, (June).
- Krimmer, R., Ehringfeld, A., & Traxl, M. (2010). The use of e-voting in the Austrian federation of students elections 2009. *Electronic Voting 2010, EVOTE 2010 - 4th International Conference*, 33–44.
- Krimmer, R., Triessnig, S., & Volkamer, M. (2007). The development of remote e-voting around the world: A review of roads and directions. In *International Conference on E-Voting and Identity* (pp. 1–15). Springer Berlin Heidelberg.
- Salau-Ibrahim, T. ., & Abdulsalam, S. . (2016). Design and Implementation of Electronic Election Campaign System. *Al-Hikmah Journal of Pure and Applied Sciences*, 2(2), 122–129.