

USING FINGER VEIN BIOMETRIC FOR VOTING SYSTEM ENHANCEMENT IN NIGERIAN GENERAL ELECTIONS

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ABSTRACT

Recent trends of technological advancement has seen the various sectors within several economies in the world adapt technological means into their operations; such adaptation has in most cases proven to be of immense value. Therefore, it is coherent that technology also be further applied in the Nigerian electoral system. E-voting therefore, is an effective way of applying technology in the electoral system as it eliminates certain discrepancies which are experienced in its absence. Further integrating it with biometric authentication deepens its level of accuracy and trustworthiness as issues of voter redundancy can be duly addressed.

A brief inquiry was carried out to review the current and previous systems used for voting. An official of the Independent National Electoral Commission (INEC) was interviewed orally to gain understanding of the current system of voting and also to view his opinion of the proposed system. The outcome of the interview was analyzed and then fed into the design process.

This paper project the use of finger vein as a biometric property for access control and integrating it into electronic voting system. With this, the usefulness, effectiveness and accuracy of this biometric technology are quite evident in election process.

Keywords: Finger vein, Biometrics, Election, Voting System, Nigeria

1. INTRODUCTION

In time past, it has always been observed that almost every electoral process of voting has always been greeted by lack of proper record keeping pertaining voters, rowdiness in some voting sessions, inaccuracy in voting result and delay in the release of election outcome

With the universal use of elections as a tool for selecting representatives into various offices or positions, the increasing need to ensure that elections are made use of as effectively as possible is of utmost interest to not just the general public but also the electoral body/commission and as such, the introduction of electoral reforms which involves the process of introducing fair electoral systems where they are not in

place, or improving the fairness or effectiveness of existing systems is of increasing necessity.

In carrying out electoral reforms, several technologies could be applied; examples of such are the electronic voting (the use of a computer rather than the traditional use of ballot at polling centers or by postal mail) (Hajjar *et al*, 2012) and the biometric authentication (the identification of humans by their characteristics or traits, used in computer science as a form of access control) (wikipedia, 2012) technologies. Considering the fact that elections are formal decision making processes by which a population chooses an individual to hold public office, it is fundamental that the outcome of the voting sessions involved in the electoral process is accurate and concise and as such project the actual decisions made hence the integration of biometric authentication with an electronic voting system would be of high value to the aim of socio-economic development.

This work would involve the usage of a biometric identifier that is a distinctive, measurable characteristic of an individual. This unique identifier would be the finger vein of the individual; the vein patterns inside the finger are unique and since they are inside the body, they are virtually impossible to replicate; hence, it would be of great value when integrated into the development of an electronic voting software which would provide a reliable and easy to use platform for voters to cast their votes during voting sessions.

2. E-VOTING

E-voting involves participating in the voting process electronically, without the use of paper and ballot boxes (Hazzaa and Kadry, 2012). It is a term used for several different types of voting encompassing both the electronic means of casting a vote as well as an electronic means of counting votes.

Electronic voting can be generally classified into two main types namely:

- ❖ E-voting which is physically supervised by representatives of governmental or independent electoral authorities (i.e. electronic voting machines located at polling stations); an example of which is the direct recording electronic system.
- ❖ Remote e-voting where voting is performed within the voter's sole influence, and is not physically supervised by representatives of governmental authorities (e.g. Voting from one's personal computer, mobile phone, television via the internet (also called i-voting) an example of which is the Public Network Direct Recording Electronic System.

The implementation of the E-voting system raises several issues related directly to elections such as legal, social, technical, political, administrative and financial issues. Therefore to ensure high efficiency and transparency, several measures need to be considered when implementing an e-voting system; they include:

- ❖ **Functionality:** The voting process should be functional and simple since not all voters have full knowledge of the E-voting process (Hajjar et al, 2006). The E-voting system provides a unique interface that inhibits any attempt to tamper with the system itself.
- ❖ **Confidentiality:** The voter's ballot should be accurately and confidentially registered (Hajjar et al, 2006). The confidentiality feature protects voters' choices in a way that it will be impossible to join a vote and a voter will be able to prove the voter's vote.
- ❖ **Security:** Votes cast should neither be intercepted nor tampered with; the results should not be known until the official opening of the electronic urn. Only eligible voters whose names appear on the Voters List are entitled to vote and according to the law, the voter has the right to vote one time. The system should consider invalid any vote cast before the opening or after the closing of poll. In the past few years, especially after the year 2000, the advantages and the security risk of E-Voting have been at the core of several debates (Hajjar et al, 2006).

3. THE NIGERIAN VOTING SYSTEM

The colonial rule in Nigeria brought about a system of appointing political office holders which was based on a 50-50 sharing formula between the north and the south (east and west); this electoral system employs the method of indirect elections in the north, direct elections (based on universal suffrage) in the east while in the west, natives/ residents of the administrative division who are above 21 and tax payers for a period of twelve months at the qualifying date are eligible to vote. (Moveh, 2009)

Nigeria started its transition from colonial rule in the year 1959 by conducting her first nationwide direct elections. This was done using the paper based voting system where ballot papers were distributed to voters at the polling stations after which the ballots were casted into individual candidate's ballot box in a screened booth. In 1993, the open ballot system of voting was adopted; this system involved Electors queuing behind the candidates of their choice or his photograph or party symbol to signify their support for him. Nigeria then went on to adopt a significantly different method of voting in the year 2011. This involved the creation of an electronic voter register coupled with the secret ballot system; this positioned the country for greater achievements in electoral reforms as it provides a basis for further advancement of technology in voting.

4. BIOMETRIC AUTHENTICATION

The term biometrics is derived from the ancient Greek word *bios* which means life and *metron* which means measure (Bhattacharyya, 2009). It refers to the identification of humans by their characteristics or traits; it is used in computer science as a form of identification and access control (wikipedia, 2012). There are two main categories of biometric identifiers:

- ❖ **Physiological Biometric:** this involves the identification of individuals by their physiological traits such as voice, DNA, handprint, fingerprint and finger vein.

Behavioral Biometric: this involves the identification of individuals by their behavioral traits/ characteristic such as signature, keystroke dynamics, typing rhythm and gait.

On the issue of biometric authentication, it is very important to note that authentication is primarily the act of establishing or confirming something (or someone) as authentic, that is, that claims made by or about the thing are true. With that we could then go further in defining biometric authentication as the process of verifying if a user or identity is who they claim to be using digitized biological pieces of the user. The form of biometric authentication used in this work is the finger vein authentication which uses the human finger vein as a unique biometric property.

- ❖ **Finger-Vein Authentication**

Finger vein authentication uses leading-edge light transmission technology to undergo pattern-matching and authentication. Near-infrared light is transmitted through the finger and partially absorbed by hemoglobin in the veins to capture a unique finger vein pattern profile, which is then matched with a pre-registered profile to verify individual identity (Hitachi, 2009)

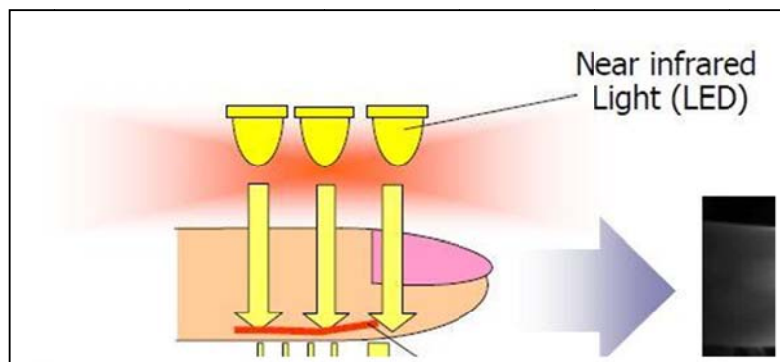


Figure 1: Finger-vein recognition Process (Source: Hitachi)

5. THE SYSTEM

This system (Finger Vein E-voting System) allows voters to enter their votes by clicking buttons on a computer system; it uses finger vein biometric authentication. This system contains 2 portals: Voter and Admin. The voter portal contains controls that allow each registered voter to cast his/ her vote. The Admin portal provides a platform for creating election events, voter registration, and also candidate's registration amongst others. This system employs biometric authentication as a means of access control; the biometric property used is the finger vein of the user.

6. ACTIVITY DIAGRAM

Activity diagrams model an objects activity during program execution. An activity diagram is a flowchart that models the action the object will perform and in what order. (Deitel and Deitel, 2004)

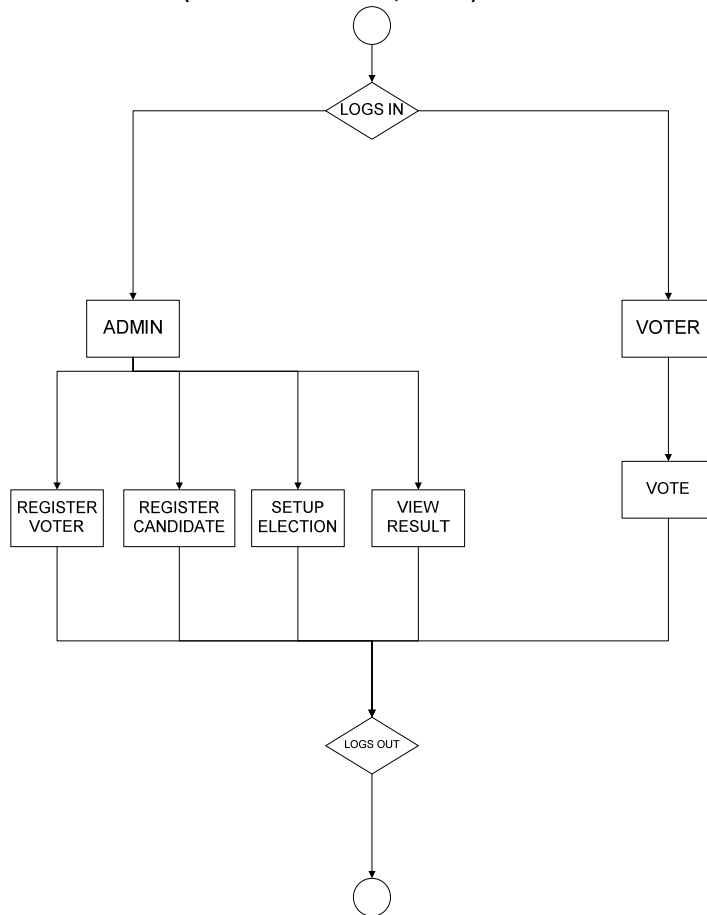


Figure 2: Activity Diagram of the Proposed System

7. RESULT

Figure 3 shows the default/index form of the application as well as the login form for both voter and administrator. The voter can navigate to the voting form through this interface and the admin can access the system's administrative functions through this same interface.

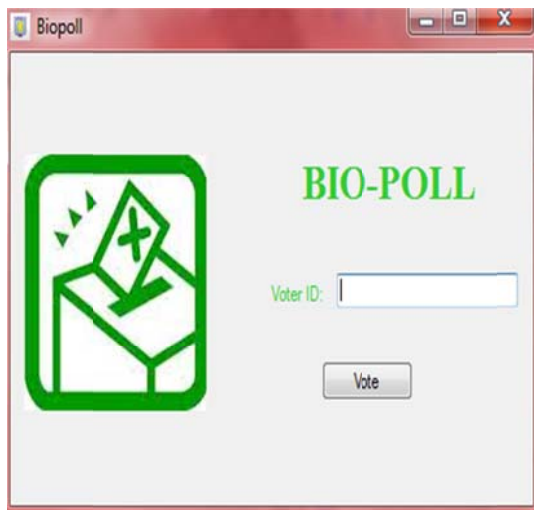


Figure 3: Login Form

Figure 4 & 5 contains controls required to obtain voter's details needed for the voter to proceed to vote. It is imperative for voters to be registered so as to have adequate knowledge about those responsible for selecting public office holders. Each voter is assigned a voterId, once he/she is registered and his biometric property obtained using the finger vein reader via the bio-plugin server with his voterId as his/her unique Id.

VReg

 Voter Registration

First Name Middle Name Last Name

Age Occupation TIN

Marital Status Date of Birth

Address

Instructions
Please click the boxes below to begin scanning your fingers.

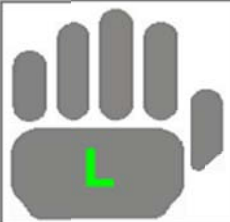
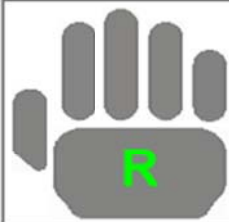
 

Figure5: Biometric Capture Selection

Figure 6 provides a platform for voting; every voter is directed to this page to cast his/her vote. The voter is also allowed to view his/her bio-data on this form.

Figure 6: Voting Page

Figure 7 presents election result under the admin interface.

	Babaginda	Jonathan
▶ 1	1	1
1	1	1
1	0	0
1	0	0
0	0	0
4	2	2

Figure 7: Result Page

8. CONCLUSION

An electronic voting system has been developed using Finger vein authentication. This system has provided an efficient way to cast votes, free of fraud, and make the

system more trustable, economic and fast. As Nigeria is becoming more prominent on a global scale, the implementation of such an e-voting system would offer better trust in whoever is elected based on the outcome of the election. This project work has helped shed light on the various factors surrounding elections, voting, e-voting and their possibilities in the Nigerian electoral system.

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