

**Proceedings
of the 6th International
Conference on
e-Government**

**Cape Peninsula University
of Technology
Cape Town
South Africa**

30 September – 1 October 2010

Edited by
Ernie Ruiters
Cape Peninsula University of Technology
South Africa



An End-to-End e-Election System Based on Multimodal Identification and Authentication

Charles Ayo¹, Justine Daramola¹, Obi Gabriel² and Adetokunbo Sofoluwe³

¹Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria

²International Business Systems (NIG) Ltd, Alagomeji, Yaba, Lagos, Nigeria

³Department of Computer Science, University of Lagos, Lagos, Nigeria

ckayome@yahoo.com

dwanade@gmail.com

gmm.obi@consultant.com

absofoluwe@yahoo.com

Abstract: The spate and intensity of controversies and irregularities that usually trail the conduct of elections in most developing nations of the world are national albatrosses that must be removed, as they clog the wheel of true development in any nation. Concerted efforts were made through the introduction of e-Voting as a panacea for eliminating these development-inhibiting influences and achieving reliable democratic governance, but without much success. In any case, e-voting is just one of the components of an electoral system, and adopting a holistic approach to the development of an e-election system, appears imperative for an endearing solution to the debilitating pre-, contemporaneous and post- election events. In the particular case of the Federal Republic of Nigeria, the challenges of the electoral system were observed at four (4) major phases: registration of voters, political parties and candidates, and the security of election data; voting (voter identification and authentication, and ballot casting); ballot tallying; and the transmission of votes from the polling booth to the various collation centres. This paper presents an end-to-end e-Election system, covering the aforementioned areas with adequate security measures based on a multimodal identification and authentication system, and cryptography.

Keywords: e-Election, e-Voting, e-Registration, e-Counting, e-Transmission, Authentication, and Cryptography

1. Introduction

One of the major reasons why elections had ended up in chaos in many developing nations of the world is partly because of lack of internal democracy, poorly implemented electoral procedures or to a lesser extent, the over-reliance on e-Voting as a panacea for successful elections and democracy (Ayo et al. 2008). While appreciating that e-Voting is very important it is noted that realizing effective elections is more than just e-Voting. Thus in this research work an omnibus system that presents a holistic view of an electoral system is proposed, the intent being to proffer a lasting solution to the quest for an effective, sustainable electoral system. In this regard, this paper considers the following components of e-Elections: e-Registration, e-Voting, e-Tallying and e-Conflict resolution (audit trail).

The proposed e-Registration is expected to address a number of challenges that are associated with the manual system. A database of voters with their biometric data, particularly the fingerprint, is created, which is to be employed to support a 3-factor authentication protocol (Voter's card, PIN and fingerprint) thereby ensuring creditability of the entire system (Ayo, 2009). The e-Registration addresses the mix-up in voters' records, makes available to the electorates current and timely information when needed as well as facilitate future election data updates. Secondly, the authentication of political party nominees ensures that accurate data of candidates are properly stored, and are verified before the commencement of elections.

Since independence, Nigeria has longed for a credible voting system because of the irregularities that trailed previous elections. Participation at elections had been uninspiring and disputes on the conduct and results of elections have been commonplace. In the developing countries particularly the Sub-Saharan Africa and Africa in general, elections had been marred by gross irregularities leading to wanton destruction of lives and properties (Helen, 2005, Iyayi, 2004, Okoye, 2004). Particularly in Nigeria, the large scale controversies and bickering that usually attend the conduct of elections is a pointer to the structural and operational deficiencies of the extant electoral system.

An effective e-Election system properly implemented at worst reduces these development impeding experiences, yet ensuring strict compliance with international principles of democratic elections and referendums: 1) freedom to vote; 2) secrecy of vote; 3) non-modification of the votes cast; and 4) lack of intimidation during elections (ACE Encyclopedia, 2008). The motivations for e-Election include: