



## Overview of Biometric Electronic Voting System in Ghana

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**Abstract**— This paper presents the overview of the development and implementation of Biometric Electronic Voting System Software (BEVSS) in Ghana. Many African countries have proposed electronic voting system for their national elections, this paper as a case study for Ghana would be a pivotal reference to speeding up their implementation. Microsoft Visual Basic 2010 is used to develop the BEVSS at the front end and SQL Server Database at the backend. The BEVSS is integrated with a biometric fingerprint machine to scan the finger print of eligible voters during the registration process and for the authentication or verification on Election Day. The BEVSS would be implemented on personal computers over a Local Area Network at each polling station.

**Keywords**— Biometric, Electronic Voting, Fingerprint, Verification

### I. INTRODUCTION

Election is one of the most acceptable means of selecting representatives in a democratic setting. Leaders are selected by majority of the populace and not by a “powerful” few who may not represent the overall interest and aspirations of the people [1]. Throughout history, election fraud has occurred in many electoral processes from which experience shows that the manual (paper) voting process is a major source of such vices and violence in many democratic countries such as Ghana [3]. Over the last few years, there have been a number of stakeholders who have suggested electoral reforms to introduce electronic voting at State and Local Government election processes. Biometric Electronic voting would be cheaper for the long term than the present paper based arrangement [3]. An electronic voting system defines rules for valid voting and gives an efficient method of counting votes, which are aggregated to yield a final result. Moreover, electronic voting systems can improve voter identification process by utilizing biometric recognition. Biometrics is becoming an essential component of personal identification solutions, since biometric identifiers cannot be shared or misplaced and they represent an individual’s identity. Biometric recognition refers to the use of iris, fingerprint, face, palm and speech characteristics, called biometric identifiers. Fingerprint matching is a significant part of this process. It is an extremely difficult problem, due to variations in different impressions of the same finger. Fingerprints are unique to each individual and they do not change over time [6]. Elections are necessary for the establishment of a functional democracy; but elections can also result in flash-points and catalysts for further violence, particularly when fraud occurs or is believed to have occurred. Pre-mature victory claims and non-acceptance of election losses even when the results are affirmed or verified by neutral third-party, missions and the exacerbation of pre-election tensions [3], Biometric electronic voting system software seeks to eliminate all of the above mentioned calamities that accompanies the aftermath of elections.

**Electoral process:** In Ghana, elections take place every four years to elect a President and the Members of Parliament for the two hundred and seventy five constituencies (275). The electoral procedure involves many processes. The processes covered by the software are voter Biometric Registration, Candidates Registration, voter verification or authentication, voting, Vote Counting, Collation and Publication of Results.

### II. OVERVIEW OF THE PROPOSED SYSTEM

Biometrics is the science that tries to fetch human biological features with an automated machine either to identify or authenticate. Biometric products eliminate the need for passwords and Personal Identification Numbers or PINs. Biometric systems exchange knowledge with individual’s features such as finger print or proximity identification. It makes it comfortable and fast to record features. The analysis of human data using the fingerprints, facial patterns, eye retinas is termed as the Biometrics. Initially the applications of biometrics were focused only on the high end consumers like government, defense and airport security. However, it has now become more commercial. Some of the commercial applications employed are; Network or personal computer login security, web page security, employee recognition, time and attendance systems, voting solutions are the commercial applications [4]. The software will be developed with Microsoft visual basic 2010 at the front end and SQL server database at the backend.

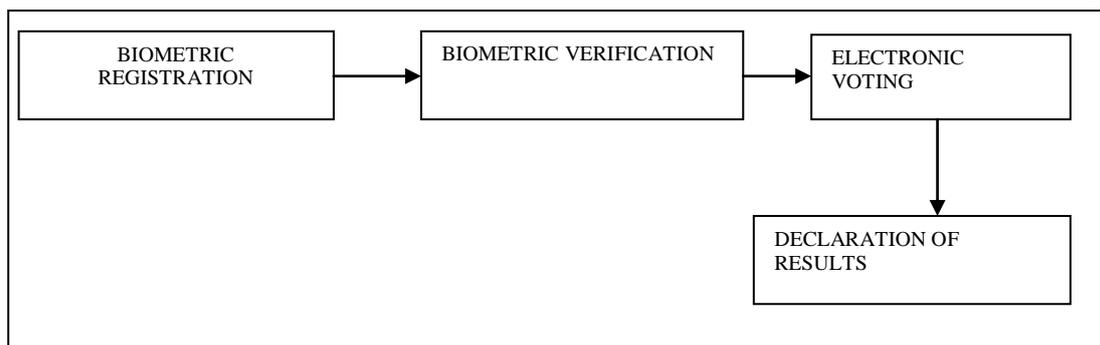


Fig 1.0 Biometric electronic voting Architecture

**Biometric Registration of voters:** This involves the process of capturing an eligible (18 years of age or above, with a sound mind, a national and resident in the country) voter’s personal information (Name, Date of Birth, Home town, Language, Address, Family, Passport, photograph, etc), including fingerprints using the fingerprint machine to scan the fingers and stored to the voters database to be used for authentication or verification on election day.

**Candidates Registration:** Each political party or Independent Candidate after passing all the requirements of the electoral processes required for contesting in the election would then be registered to the software after going through the ballot position balloting. Each candidate’s personal information (Name of Candidate, Party Name and Logo if applicable, portfolio or position vying for) would be captured and stored in the Candidate’s table on the database.

**Voter Verification or Authentication:** A fingerprint recognition system operates either in verification mode or in identification mode. The various stages in a fingerprint verification system are shown in Fig 2.0 [2].

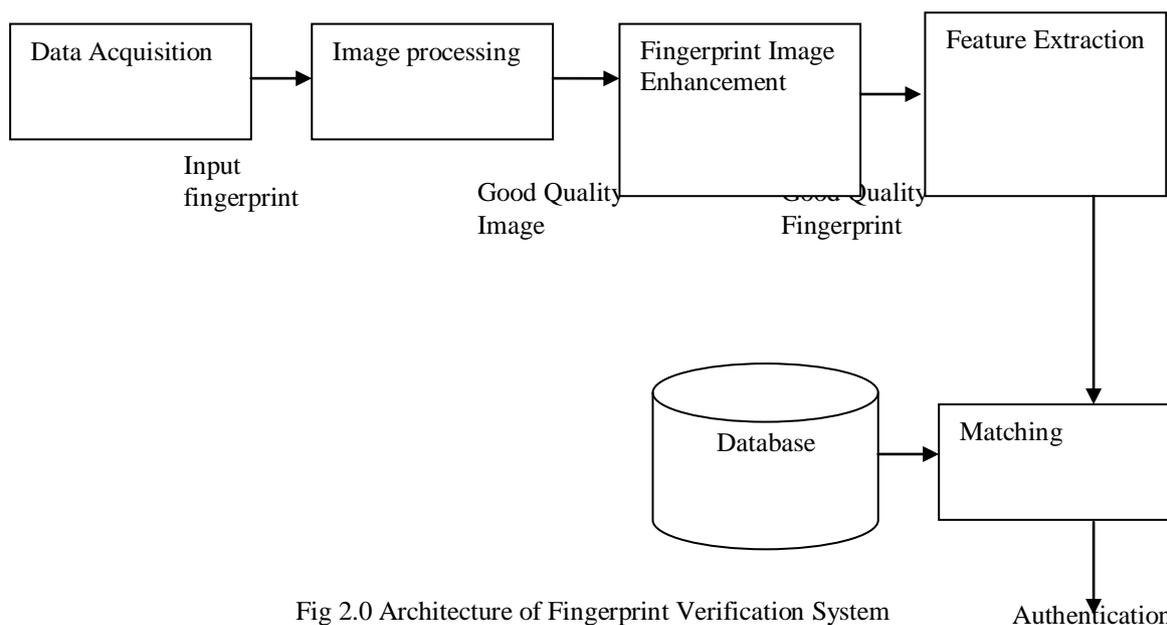


Fig 2.0 Architecture of Fingerprint Verification System

The first stage is the data acquisition stage in which a fingerprint image is obtained from an individual. The next stage is the pre-processing stage in which the input fingerprint is processed with some standard image processing algorithms for noise removal and smoothening. The pre-processed fingerprint image is then enhanced using specifically designed enhancement algorithms which exploit the periodic and directional nature of the ridges. The enhanced image is then used to extract salient features in the feature extraction stage. Finally, the extracted features are used for matching in the matching stage [2].

**Electronic Voting:** The term electronic voting and also known as e-voting is a term inclusive of many systems and methods of voting. This includes booths equipped with electronic devices, software, peripherals, processing systems, equipment, tools and screens, networks and means of communication, etc., [5].

**Vote Counting and Collation of Results:** While voting is in progress, the software would tally each candidate’s votes as and when an eligible voter selects the candidate by clicking or touching the passport size photograph, Name of the candidate or the logo if applicable. The percentage of vote cast by each candidate is calculated and their respective positions determined as soon as polls closes.



Fig 3.0 Fingerprint Scan

### Electronic Ballot

After going through authentication or verification through fingerprint, an electronic ballot is served to each voter as shown in Fig 4.0 below, a voter is expected to touch or click on **Vote** button or any part of the candidate's name, passport size photograph, party logo or picture to cast his/her ballot.

A caution message will be shown from which the voter either accepts (Yes button) or rejects (No button) the choice made.



Fig 4.0 Presidential Ballot (Electronic)

### Results of the Election

The software will make it possible to display the results after the elections by the electoral official as shown in Fig 5.0 below. The results page displays the name of the candidate and the acronym of the party, the passport photograph of the candidate, the total votes for each candidate, and the percentage of votes per candidate as well as the positions of each candidate.

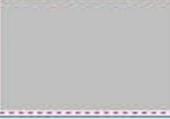
Candidate Name/Party	Picture	Number of Votes	Percentage(%)	Position
PAA KWESI NDUOM PPP		0	0.00%	1
NANA ADDO DANKWA AKUFO-AD NPP		0	0.00%	1
MICHAEL ABU SAKARA FOSTER CPP		0	0.00%	1
JOHN DRAMANI MAHAMA NDC		0	0.00%	1
JACOB OSEI YEBAOH INDEP		0	0.00%	1
HENRY LARTEY GCPP		0	0.00%	1
HASSAN AYARIGA PNC		0	0.00%	1
AKWASI ADDAI ODIKE IIFP		0	0.00%	1
ABSTAINED		0	0.00%	1

Fig 5.0 Results Sheet

### III. CONCLUSION

In this paper, a maiden overview of biometric electronic voting software that could be implemented on personal computers and used for conducting district assembly as well as national elections is presented. The software will be sufficiently robust and would stand the test of time in eliminating the numerous bottlenecks in the smooth organization of elections in Ghana. Elections results would be declared moments after the close of polls.

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