

NIGERIAN TURKISH NILE UNIVERSITY

MOBILE BASED ELECTION RESULT
TRANSMISION AND COLLATION
SYSTEM

(CASE STUDY-NIGERIA)

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IN PARTIAL FULFILLMENT OF THE
REQUIRMENTS FOR THE DEGREE OF
BACHELOR OF SCIENCE IN
COMPUTER SCIENCE

MAY-2015

NIGERIAN TURKISH NILE UNIVERSITY



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(CASE STUDY- NIGERIA)

A RESERCH PROJECT SUBMITTED TO THE DEPARTMENT OF
COMPUTER SCIENCE, NIGERIAN TURKISH NILE UNIVERSITY-
ABUJA, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR
THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN
COMPUTER SCIENCE.

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DEDICATION

I wish to dedicate this project to my dear parents Mr. Ismaila Salami and Mrs. Memunat Ismaila, and my step mum Mrs. Amina Ismaila for their immense contribution to everything, I wish to let you know that the role you play in my life is dearly indispensable, I know I cannot repay you, but I really appreciate everything, May Almighty Allah reward you abundantly (Ameen).

ACKNOWLEDGEMENT

In the name of Allah the Most Gracious, the Most Merciful. All thanks are to Allah, the Cherisher and Sustainer for his all-encompassing mercy, protection, and guidance (Alhamdulillah).

My sincere appreciation and gratitude goes my parents and all my siblings; Yusuf, Hajara, Musa, Mohammed, Nuhu, Rahimat, Abdul-Malik, Abdullahi, Dauda, Abdulrazak for their supports, encouragement.

Special Thanks to Assoc. Prof. Dr. Steve A. Adeshina; my project supervisor for his guidance, constructive comments, valuable suggestions and inspirations, and also Computer Science Department Lecturers for their general support and encouragement, and all my Friends for their support.

ABSTRACT

MOBILE BASED ELECTION RESULT TRANSMISSION AND COLLATION SYSTEM

This project aimed at reducing the time between voting activities and when the results are published, as well as reducing manual intervention with election results to the minimal.

An analysis of how elections are being performed in Nigeria was made using the data collation method of interview of individuals at election management body, observation of electoral processes as well as how election result are managed.

Election results transmission is critical to free and fair election. In this project, a result collation and transmission system was designed and implemented using Nigerian Election as a case study. Election results are collated from every polling units (about 120,000 locations) and were sent using a mobile application to a central server. These results were collated using an SQL database. Collated results are subsequently displayed in a result portal using PHP. This process leads to a huge reduction in the time it takes to collated and publish election results.

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LIST OF ABBREVIATIONS

SMS	–	Short Message Set
PU	–	Polling Unit
CSV	–	Comma Separated Values
USB	–	Universal Serial Bus
MB	–	Mega Byte
EMB	–	Electoral Management Body

CHAPTER 1

INTRODUCTION

1. Election

An election is a formal decision making process by which a population chooses an individual to hold public offices. Elections have been the usual mechanism by which modern representative democracy has operated since the 17th century. Elections may fill offices in the legislature, sometimes in the executive and judiciary, and for regional and local government. This process is also used in many other private and business organizations, from clubs to voluntary associations and corporations.

The universal use of elections as a tool for selecting representatives in modern democracies is in contrast with the practice in the democratic archetype, ancient Athens. As the Elections were considered an oligarchic institution and most political offices were filled using sortation, also known as allotment, by which office holders were chosen by lot. [2]

Electoral reform describes the process of introducing fair electoral systems where they are not in place, or improving the fairness or effectiveness of existing systems. Psephology is the study of results and other statistics relating to elections (especially with a view to predicting future results). [3]

1.2 History of Election

Elections were used as early in history as ancient Greece and ancient Rome, and throughout the medieval period to select rulers such as the Holy Roman Emperor and the Pope.

In medieval India, around 920 AD, in Tamil Nadu, palm leaves were used for village assembly elections. The leaves, with candidate names written on them, were put inside a mud pot for counting. This was known as the Kudavolai system. The Pala king Gopala in early medieval Bengal was also elected. Elections were carried out to select rajas by the gana during the Vedic Period. [1]

Ancient Arabs also used election to choose their caliph, Uthman and Ali, in the early medieval Rashidun Caliphate. [24]

The modern "election", which consists of public elections of government officials, didn't emerge until the beginning of the 17th century when the idea of representative government took hold in North America and Europe

1.3 Characteristics of Election

Suffrage: the question of who may vote is a central issue in elections. The electorate does not generally include the entire population; for example, many countries prohibit those judged mentally incompetent from voting, and all jurisdictions require a minimum age for voting.

Suffrage is typically only for citizens of the country, though further limits may be imposed. However, in the European Union, one can vote in municipal elections if one lives in the municipality and is an EU citizen; the nationality of the country of residence is not required. In some countries, voting is required by law; if an eligible voter does not cast a vote, he or she may be subject to punitive measures such as a fine.

Nomination: a representative democracy requires a procedure to govern nomination for political office. In many cases, nomination for office is mediated through preselection processes in organized political parties. Non-partisan systems tend to differ from partisan systems. In a direct democracy, one type of non-partisan democracy, any eligible person can be nominated. In some non-partisan representative systems no nominations (or campaigning, electioneering, etc.) take place at all, with voters free to choose any person at the time of voting—with some possible exceptions such as through a minimum age requirement—in the jurisdiction. In such cases, it is not required (or even possible) that the members of the electorate be familiar with all of the eligible persons, though such systems may involve indirect elections at larger geographic levels to ensure that some first-hand familiarity among potential electees can exist at these levels (i.e., among the elected delegates). As far as partisan systems, in some countries, only members of a particular political party can be nominated. Or, an eligible person can be nominated through a petition; thus allowing him or her to be listed.

1.4 Electoral systems

Electoral systems are the detailed constitutional arrangements and voting systems that convert the vote into a political decision. The first step is to tally the votes, for which various vote counting systems and ballot types are used. Voting systems then determine the result on the basis of the tally. Most systems can be categorized as either proportional or

majoritarian. Among the former are party-list proportional representation and additional member system. Among the latter are First Past the Post (FPP) (relative majority) and absolute majority. Many countries have growing electoral reform movements, which advocate systems such as approval voting, single transferable vote, instant runoff voting or a Condorcet method; these methods are also gaining popularity for lesser elections in some countries where more important elections still use more traditional counting methods. While openness and accountability are usually considered cornerstones of a democratic system, the act of casting a vote and the content of a voter's ballot are usually an important exception. The secret ballot is a relatively modern development, but it is now considered crucial in most free and fair elections.

1.5 Election in Nigeria

Nigeria elects on federal level a head of state (the President of Nigeria) and a legislature (the National Assembly). The president is elected by the people. The National Assembly has two chambers. The House of Representatives has 360 members, elected for a four-year term in single-seat constituencies. The Senate has 109 members, elected for a four-year term: each of the 36 states are divided into 3 senatorial districts, each of which is represented by one senator; the Federal Capital Territory is represented by only one senator.

Nigeria has a multi-party system, with two or three strong parties and a third party that is electorally successful. However, members of the People's Democratic Party (PDP) have controlled the presidency from 1999 until 2015 presidential election, where All Progressive Party (APC) took over.

1.6 Difficulties with Elections

In many countries, with weak rule of law, the most common reason why elections do not meet international standards of being "free and fair" is interference from the incumbent government. Dictators may use the powers of the executive (police, martial law, censorship, physical implementation of the election mechanism, etc.) to remain in power despite popular opinion in favour of removal. Members of a particular faction in a legislature may use the power of the majority or supermajority (passing criminal laws, defining the electoral mechanisms including eligibility and district boundaries) to prevent the balance of power in the body from shifting to a rival faction due to an election.

Non-governmental entities can also interfere with elections, through physical force, verbal intimidation, or fraud, which can result in improper casting, counting of votes and most importantly result manipulation. Monitoring for and minimizing electoral fraud is also an ongoing task in countries with strong traditions of free and fair elections. Problems that prevent an election from being "free and fair" take various forms:

- Lack of open political debate or an informed electorate

The electorate may be poorly informed about issues or candidates due to lack of freedom of the press, lack of objectivity in the press due to state or corporate control, and/or lack of access to news and political media. Freedom of speech may be curtailed by the state, favoring certain viewpoints or state propaganda.

- Unfair rules

This can include Gerrymandering(gerrymandering is a practice that attempts to establish a political advantage for a particular party or group by manipulating district boundaries to create partisan advantaged districts.), exclusion of opposition candidates from eligibility for office, and manipulating thresholds for electoral success are some of the ways the structure of an election can be changed to favor a specific faction or candidate.

- Interference with campaigns

Those in power may arrest or assassinate candidates, suppress or even criminalize campaigning, close campaign headquarters, harass or beat campaign workers, or intimidate voters with violence.

- Tampering with the election mechanism

This can include confusing or misleading voters about how to vote, violation of the secret ballot, ballot stuffing, tampering with voting machines, destruction of legitimately cast ballots, voter suppression, voter registration fraud, failure to validate voter residency, fraudulent tabulation of results, and use of physical force or verbal intimidation at polling places.

Equally this list is only some of the ways in which it can occur, other examples may include persuading candidates into not standing against them. Some examples include: blackmailing, bribery, intimidation or physical violence

1.7 Problem statement

This project is intended to enhance the election result management system, by ensuring accurate and transparent management of election results from polling units to the final display of result on a webpage. This is because election result is generally faced with a lot of issues arising from poor processing technique, resulting into failure or generally an unsuccessful system. Manipulation of election is often done between voting and the announcement of the results, in the last Nigerian election, this took about 4 days. This is a problem that this project seek to solve.

1.8 Project Objectives

The full implementation of this problem aim to solve some key issues in election result management.

- To design a result transmission system
- To reduce the cost of using computers to collate results in about 120,000 locations
- To reduce time interval between voting and result announcement
- To reduce manual intervention with election results.
- To publish result on the website.

1.9 Scope and Limitation

This project is designed to be used for managing election results after vote exercise has been completed, by transmitting the election result through an android SMS application from the polling units to result collation center, from where all election results are collated in a database. The final election results will then be displayed on a web page.

In this project, result will be transmitted from (about 120,000 locations) across Nigeria and therefore, SMS messages of the election results will be send from those location.

CHAPTER 2

2. LITERATURE REVIEW

2.1 The Voting Strategy of Nigeria Electoral System

Nigeria, one-third larger than Texas in area and the most populous country in Africa, is located on the gulf of Guinea in West Africa. It is bordered by Niger and Chad to the north, Cameroon to the east, and Benin to the west. The lower course of the Niger River flows south through the western part of the country into the Gulf of Guinea. Swamps and mangrove forests border the southern coast, while in land are hardwood forests. The Nigeria Electoral system is the single member constituency type with competitive multiparty and the first past the post winner system. The method of voting used in four out of five past elections, that is, in 1979, 1983, 1999 and 2003 was the Open Ballot System (OBS) in which the prospective voter goes through a process of accreditation, receives a ballot paper from the appropriate poll official and thereafter makes the confidential thumb impression in favor of the political party or candidate of choice in a secret voting compartment before dropping the ballot in the box positioned in the open before officials, security and party agents. The modified open ballot system was adopted in the 1993 elections in which voters filled behind the party symbol or photograph of the candidate of choice. Voters were physically counted at the close of polls and the results declared to officials, security and party agents. Although the method is simple and produced what many in Nigeria have often described as the fairest and most peaceful elections in the country, the election was unsuccessful.

The independent National Electoral Commission (INEC) is a national agency charged with the conduct and supervision of elections. In the late 1990s, the agency began modernizing its information technology infrastructure by migrating from an outdated legacy voting system heavily dependent on inaccurate paper records and polling cards to the newer Electronic Voting System (EVS). At the heart of EVS is the Electronic Voter Register (EVR), which, by capturing the names of all eligible voters, eliminates duplication and thereby minimizes discrepancies in the electoral process. As such, EVR is viewed as a means of ensuring free and fair elections in Nigeria. As part of the modernization process, INEC needed to inventory and spatially locate the agency's 120,000 polling locations scattered around the country. These locations and their attributes needed to be linked to EVR. Rigging has been the common problem that is facing the general electoral system; these and many others are manifested as follows:

Ballot paper hijack, Incorrect thumb print rendering the vote void, Lack of voters security confidentiality, Delay of electoral materials resorting a large queue, hence discourage the voters interest in the voting process, Inaccuracy in counting and collating of the electorate votes. Although the current system has reduced some of the election malpractice as described above, and was able to provide some level of democratic dividend to about thirty to forty percent (30%-40%) but yet to meet up with the international standard for the provision of viable, successful and generally accepted electoral system for democracy.

2.2 A Server-Based Multi-threaded System (Nigeria)

The existing system of voting in Nigeria is the 'traditional' method; which is done by distributing ballot boxes to all the polling centres in the local government (LG) areas of the nation, where each eligible voter is expected to come and vote for the candidate of their choice. Thereafter, ballot papers are counted in each polling centres in the presence of voters and party representatives, then the total votes for each party is announced and recorded on paper. For Presidential election the result is then hand-carried to the collating centre for the LG and then from the LG to the state level and finally to the National level for the final collation. With the availability and proper use of modern information and communication technology/applications, it is possible to transfer and collate the data without physically moving the data. In traditional Client-Server mode of communication, a good number of the information retrieval systems do not offer enough flexibility for distributed data repositories [16]. There are many specifications in the traditional way; setting up a connection between the client and the server, sending a request to the database server and receiving the result from the server. If there are X servers in the network, the user has to start X network connections and send out X database queries. The network connection must be maintained all through the process. When there are more and more mobile devices, the bandwidth becomes limited and the devices cannot be online always. At that time, the traditional client-server approach would be cumbersome to run. A popular current solution to resolve these problems is a distributed and flexible mobile agent based architecture [16]. Using Mobile Agents (MA), it is possible to retrieve data from multiple information systems that exist in a distributed environment. This work is aimed at designing and implementing a server-based multithreaded application, with the aide of mobile agents, which is capable of migrating from one host to the other in order to collate the result of any elections held in Nigeria. Briefly, some of the attributes that

define an agent were identified as autonomy, communication ability, reactivity, mobility and pro-activity.

2.3 Kosovo Demokra Technology

Central Election Commission of Kosovo as a trustworthy partner of iVote, used upgraded Demokra election platform for the parliamentary elections held on 8th of June 2014. Count and result center of Kosovo have been processing the ballots from 2374 polling stations all across the country and published preliminary live results to the public. Election night results web site accompanied with mobile applications allowed live transmission of the results at the same night after polling stations were closed. Demokra technology enabled full elections life cycle management of all phases of electoral processes. Starting from preparation activities until generating final reports with results and allocation of mandates, iVote's flagship election platform systematized many processes, estimations and computations. CEC specific needs and demands were considered and incorporated to the latest functions of Demokra system, making it elections processes more sophisticated and easy-processing.

2.4 Revolutionary Election Technology in Macedonia 2014

State Election Commission of Macedonia, once again trusted iVote Demokra to provide transparent, timely and credible presidential and parliamentary elections. For the first time in Macedonia and the Balkan region data scanning and verifying technology has been implemented. System automatically recognized handwritten numbers of the Municipal Election Commission reports. Data then have been processed and sent for final approval. With this technology SEC of Macedonia significantly reduced time needed for administering these reports. Demokra has been developed offering increased number of modules and functionalities such as: electoral configuration and administration, monitoring Election Day, audit and investigation, allocation of mandates, timely generation, calculation and presentations of the reports. This new generation of Demokra platform incorporates e-learning management system and SCORM packages for the SEC staff. More than 5 million ballots have been processed from 3514 polling stations and after 2 hours after the closing of the polling stations official preliminary results were available at the ENR web site and mobile applications.

2.5 Albanian Election Results Transmission System

The Central Election Commission of Albania this year has implemented the integrated elections management information system for the June 23 parliamentary elections. The software was developed in close cooperation between the CEC directorate for information technology and the technical team of the USAID funded project in Albania of the International Foundation for Electoral Systems. As a part of the IFES team, iVote's leading consultants contributed to deliver Integrated Election Management System in a limited time period. The system was developed using cutting edge technologies and for the first time in Albania, live results and turnout data were published online, during the counting process at the Parliamentary Elections 2013.

A separated website that is part of the system was online all day presenting the turnout and in the night started showing real time result to all the citizens of Albania and to the whole world. The results were presented on two mobile applications also: Android and iOS. They showed the results in real time too and with them, CEC improved the accessibility to the relevant data. This tailored product for smart phone users provided full statistics and results on all the levels.

2.6 Concluding Remarks

Though different technology has been applied in different countries of the world. The peculiar nature of Nigeria require that a home grown technology be employed. The peculiarity has to do with the independent penetration of internet access (30%), difficult terrain among others.

In this project, we have chosen to manage election results through effective transmission and collation to ensure that manual intervention is significantly minimized. This project, aimed to use SMS to transmit election results from polling unit to a result collation centre, in order to avoid cases of cellular failure, or other potential difficulty.

CHAPTER 3

3. METHODOLOGY

3.1 Adaptive modelling methodology (Agile)

Agile software development is a group of software development methods based on iterative and incremental development, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams. It is a methodology for the creative process that anticipates the need for flexibility and applies a level of pragmatism into the delivery of the finished product. It promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach, and encourages rapid and flexible response to change.

This project adapted the agile methodology because it involves the creative process that anticipates the need for flexibility and applies a level of pragmatism into the delivery of the finished product. It promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach, and encourages rapid and flexible response to change that may occur at any time after this project have been deployed. The methodology provides some useful advantages; useful to clarify requirements when there are uncertain scopes or changing requirements, constant feedback reduces the project risk.

3.2 Software Development life cycle

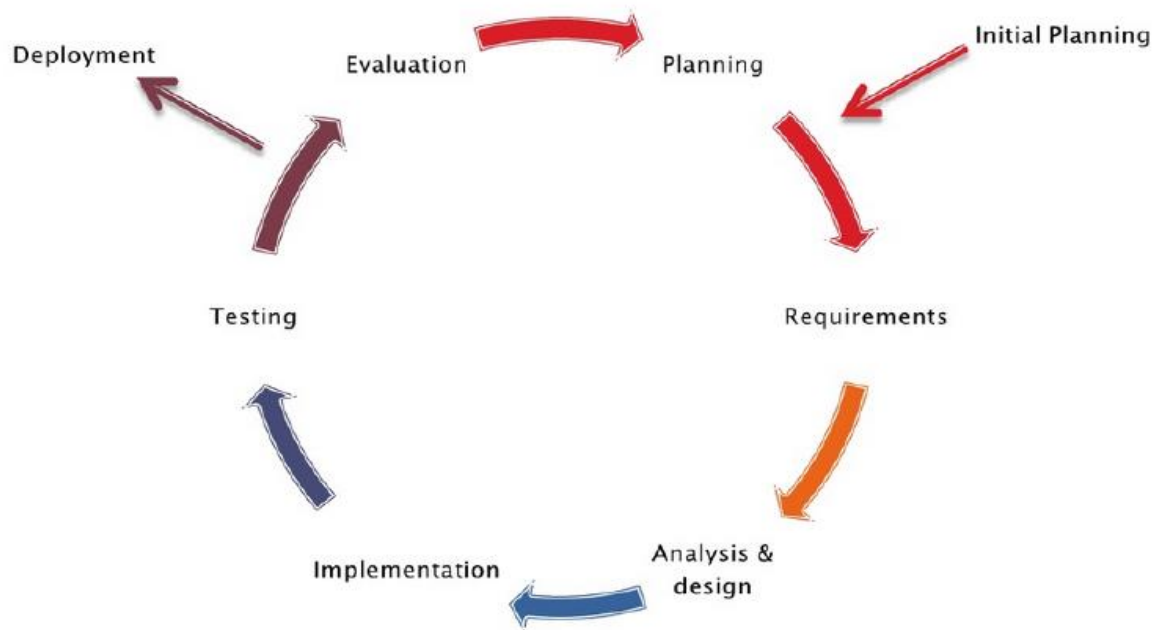


Fig. 3.1 Iterative and incremental methodology (Agile)

3.3 Requirement Analysis and Specification: I carried out some research, interview, and observations in order to know, the requirements of this project.

I visited a director in ICT department at INEC (Election management body in Nigeria), who explained to me what the necessary requirements are in this project. He also asked me to make effective planning on the scope of the project.

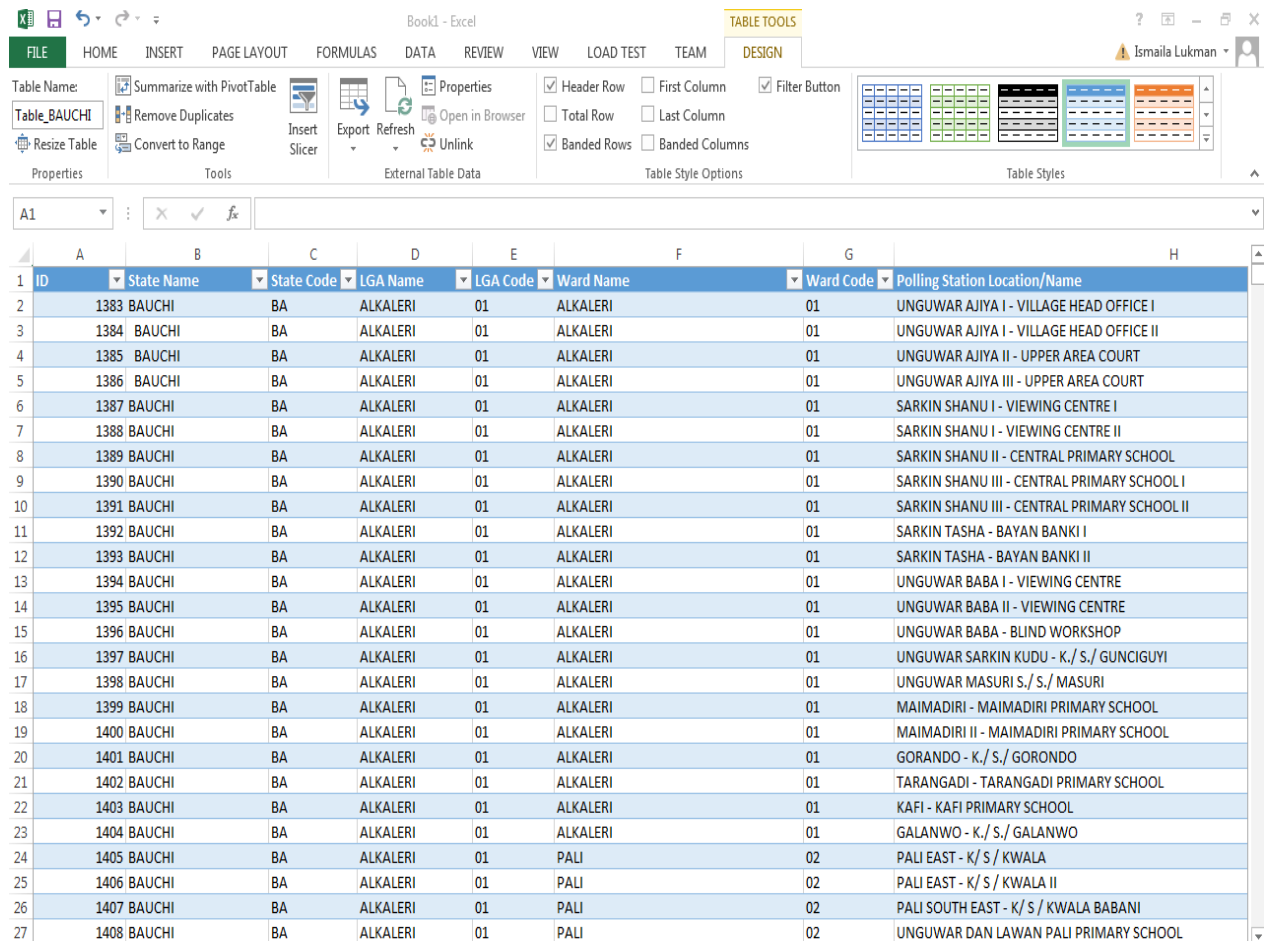
A full PU_Delimitation Database was gotten from Google fusion table and other observations were made to analyze election result management as well as the proper format of results on the output screens.

Hardware and Software Requirements include:

- PC(windows OS)
- Wamp-server
- Election Result Application
- Android device(API-10 and above)
- Database
- Web page

3.4 System analysis: this stage of the project, some observation and necessary interview on how elections are generally carried out in Nigeria and also to give me understanding of how a system like this is supposed to work a diverse environment like Nigeria and a close look at past cases of election result mismanagement, gave me clear idea on potential threats to the proposed system as well as a number of challenges during this work.

The figure below shows the a screen shot of Election result Table from INEC



ID	State Name	State Code	LGA Name	LGA Code	Ward Name	Ward Code	Polling Station Location/Name
2	1383 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR AJIYA I - VILLAGE HEAD OFFICE I
3	1384 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR AJIYA I - VILLAGE HEAD OFFICE II
4	1385 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR AJIYA II - UPPER AREA COURT
5	1386 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR AJIYA III - UPPER AREA COURT
6	1387 BAUCHI	BA	ALKALERI	01	ALKALERI	01	SARKIN SHANU I - VIEWING CENTRE I
7	1388 BAUCHI	BA	ALKALERI	01	ALKALERI	01	SARKIN SHANU I - VIEWING CENTRE II
8	1389 BAUCHI	BA	ALKALERI	01	ALKALERI	01	SARKIN SHANU II - CENTRAL PRIMARY SCHOOL
9	1390 BAUCHI	BA	ALKALERI	01	ALKALERI	01	SARKIN SHANU III - CENTRAL PRIMARY SCHOOL I
10	1391 BAUCHI	BA	ALKALERI	01	ALKALERI	01	SARKIN SHANU III - CENTRAL PRIMARY SCHOOL II
11	1392 BAUCHI	BA	ALKALERI	01	ALKALERI	01	SARKIN TASHA - BAYAN BANKI I
12	1393 BAUCHI	BA	ALKALERI	01	ALKALERI	01	SARKIN TASHA - BAYAN BANKI II
13	1394 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR BABA I - VIEWING CENTRE
14	1395 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR BABA II - VIEWING CENTRE
15	1396 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR BABA - BLIND WORKSHOP
16	1397 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR SARKIN KUDU - K./S./ GUNCIGUYI
17	1398 BAUCHI	BA	ALKALERI	01	ALKALERI	01	UNGUWAR MASURI S./ S./ MASURI
18	1399 BAUCHI	BA	ALKALERI	01	ALKALERI	01	MAIMADIRI - MAIMADIRI PRIMARY SCHOOL
19	1400 BAUCHI	BA	ALKALERI	01	ALKALERI	01	MAIMADIRI II - MAIMADIRI PRIMARY SCHOOL
20	1401 BAUCHI	BA	ALKALERI	01	ALKALERI	01	GORANDO - K./ S./ GORONDO
21	1402 BAUCHI	BA	ALKALERI	01	ALKALERI	01	TARANGADI - TARANGADI PRIMARY SCHOOL
22	1403 BAUCHI	BA	ALKALERI	01	ALKALERI	01	KAFI - KAFI PRIMARY SCHOOL
23	1404 BAUCHI	BA	ALKALERI	01	ALKALERI	01	GALANWO - K./ S./ GALANWO
24	1405 BAUCHI	BA	ALKALERI	01	PALI	02	PALI EAST - K/ S / KWALA
25	1406 BAUCHI	BA	ALKALERI	01	PALI	02	PALI EAST - K/ S / KWALA II
26	1407 BAUCHI	BA	ALKALERI	01	PALI	02	PALI SOUTH EAST - K/ S / KWALA BABANI
27	1408 BAUCHI	BA	ALKALERI	01	PALI	02	UNGUWAR DAN LAWAN PALI PRIMARY SCHOOL

Fig. 1 Result Database from INEC

3.4 System Diagrams

The project has various diagram in other to capture the dynamic behavior of the systems under various situations.

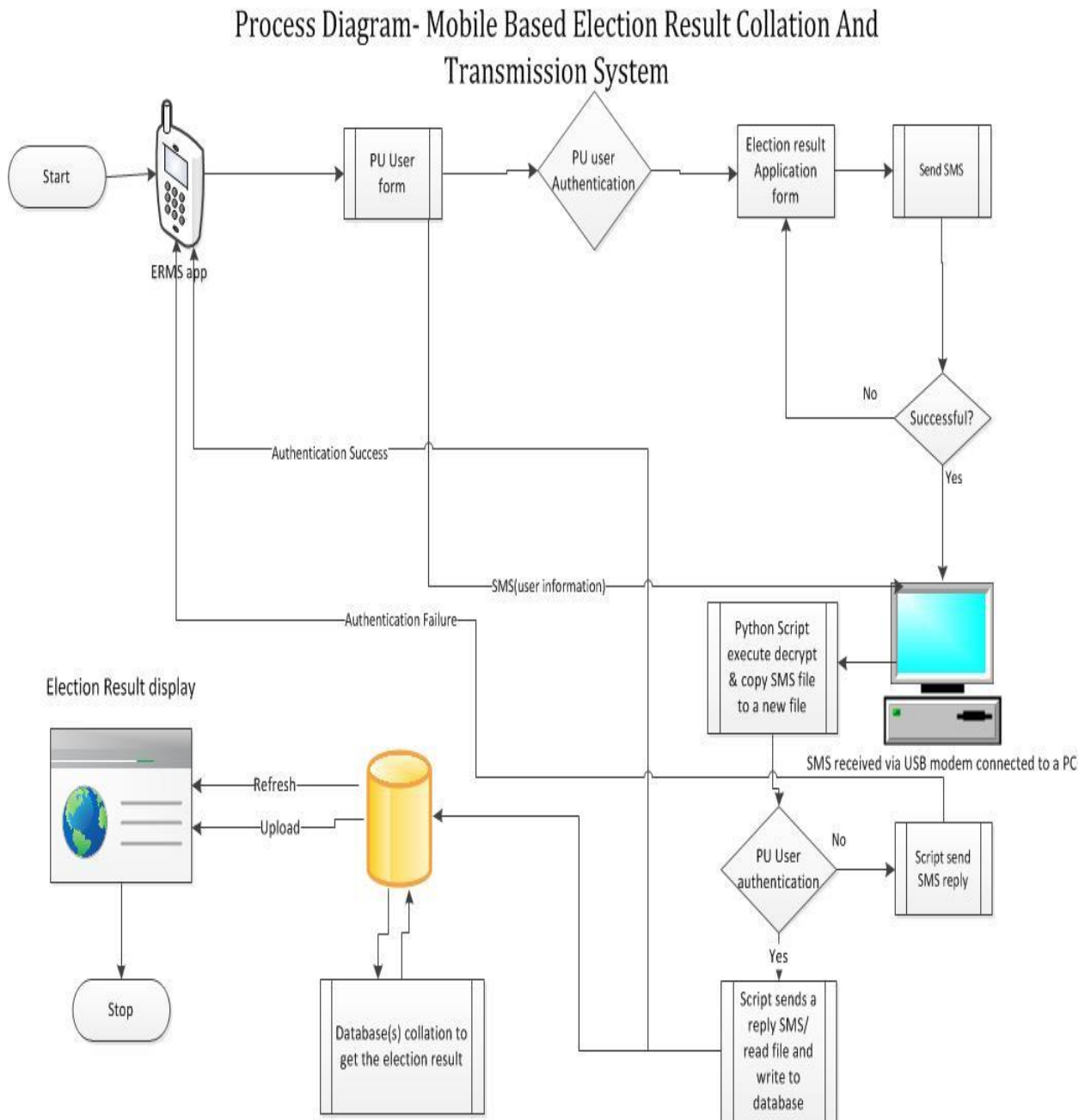


Fig.2 Project Process diagram

Activity Diagram- Mobile Based Election Result Collation And Transmission System

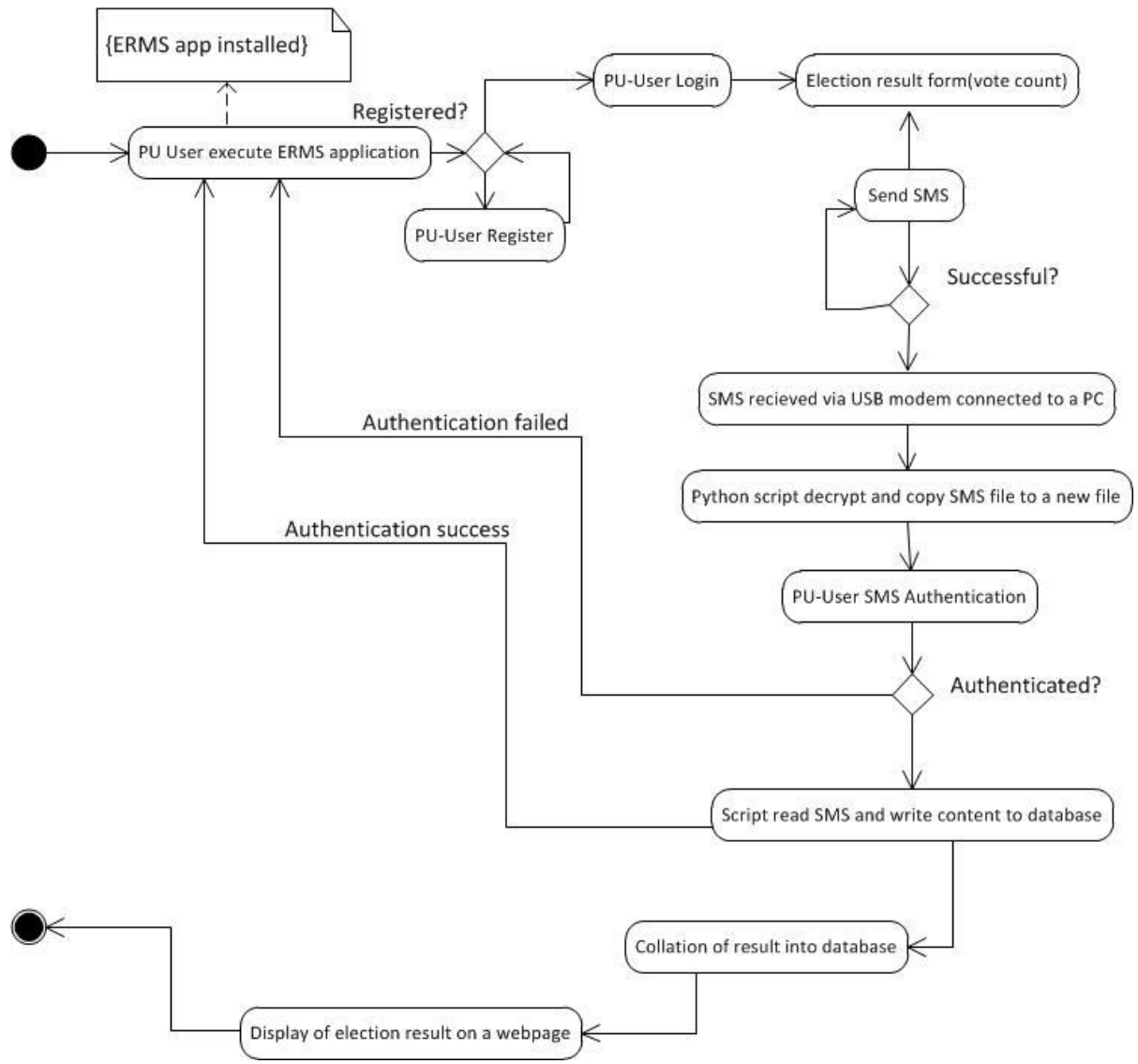


Fig. 3 Project Activity diagram

Deployment Diagram- Election Result Transmission and Collation System

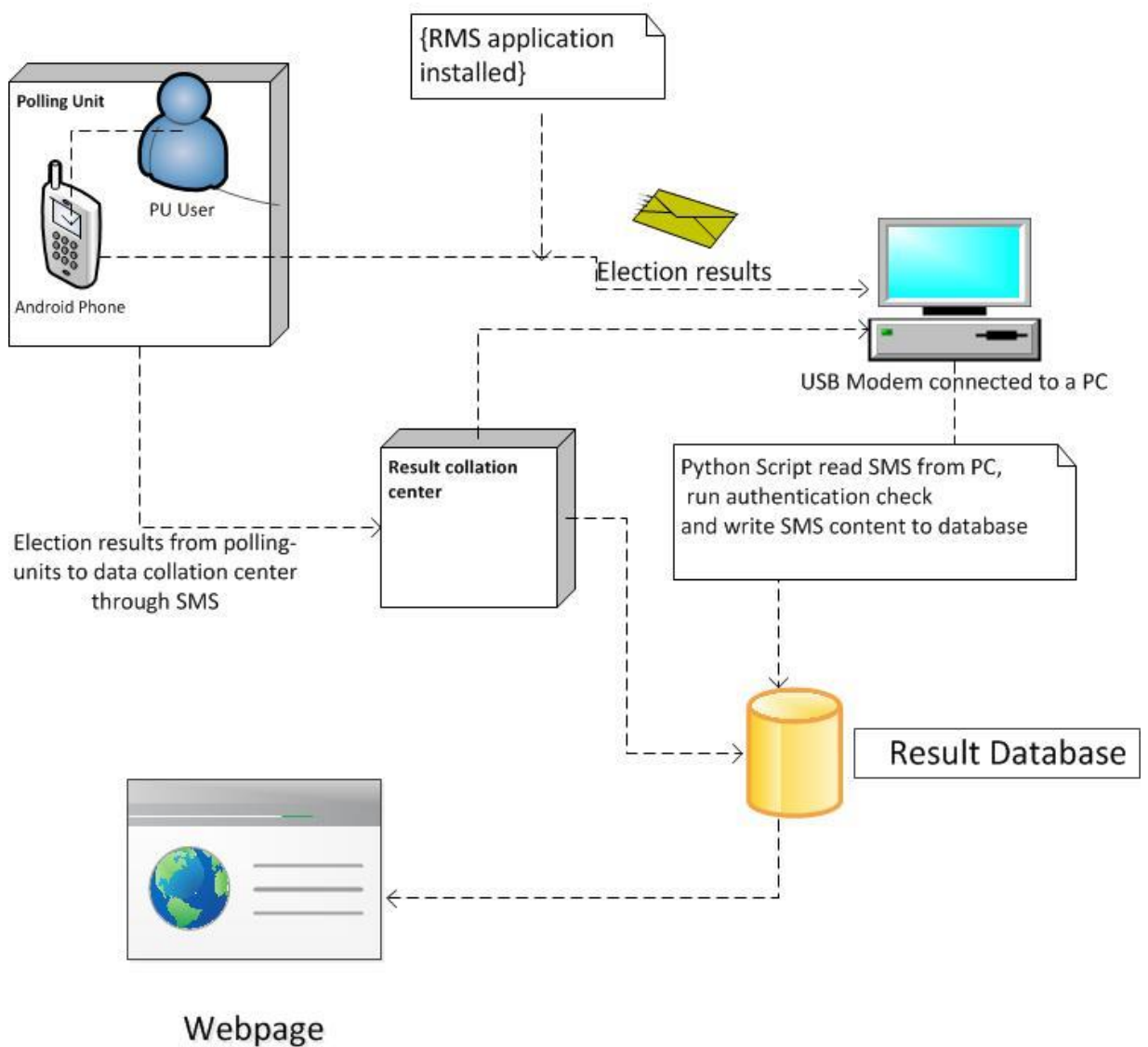


Fig. 4 Project Deployment diagram

Database E-R Diagram- Election Result Transmission and Collation System

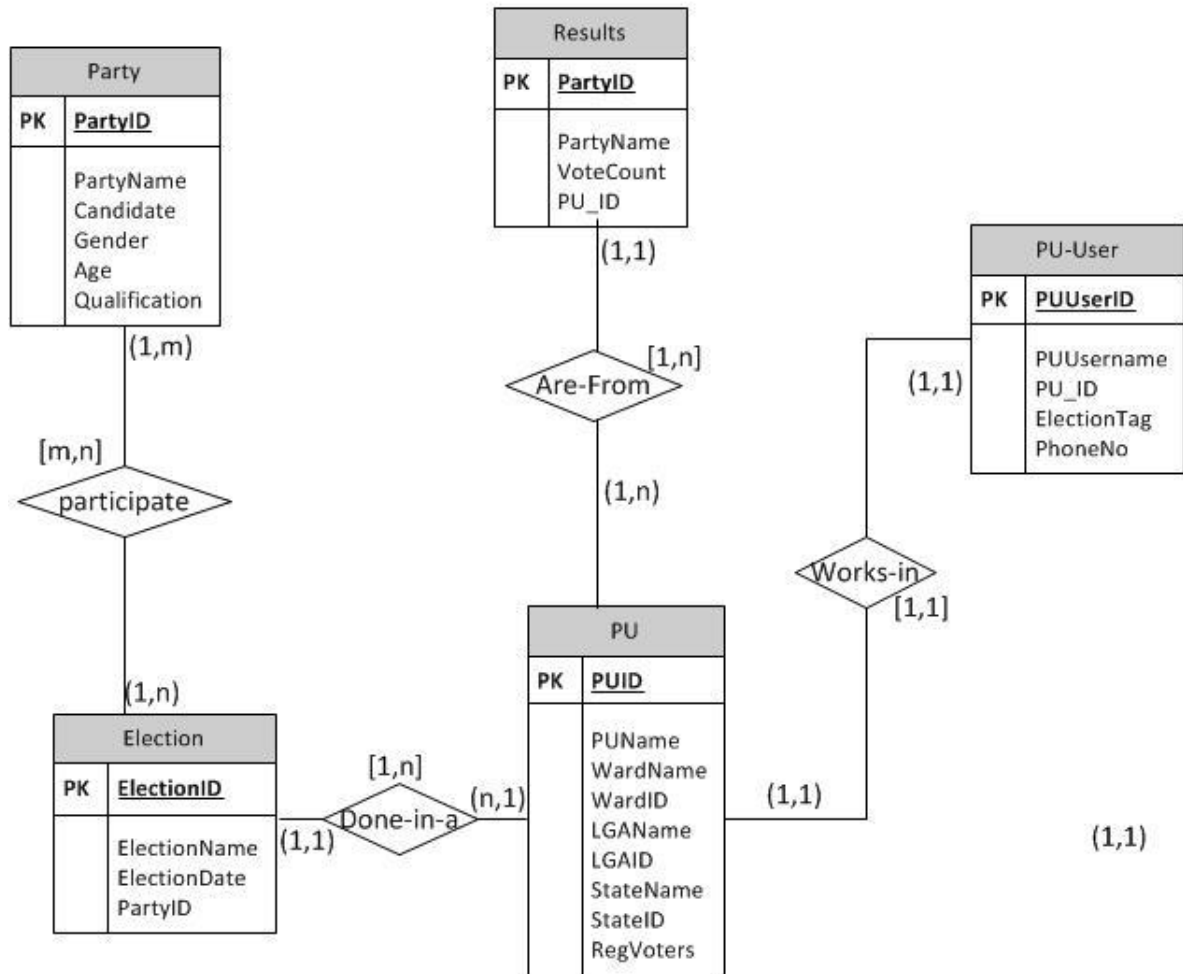


Fig. 6 Database Entity Relationship Diagram

4.6 Consideration of Alternative design

4.6.1 Alternative A: This system could have been designed, to send election result through the internet to a result collation portal where results are saved to the result database and then displayed on a web page.

A design to use the internet for sending result from about 120,000 different locations across Nigeria is not considered suitable because, internet access is not readily available in Nigeria especially in rural area, therefore such places will not be able to send their results after election has been done due to unavailability of internet access. The choice of SMS for our system is considered the alternative solution to this problem.

4.6.2 Alternative B: This system could have been designed to use computers (PC) to collate results from polling units, before results are being sent to the collation centre for display on the webpage.

This above design will have cost disadvantage as computers have to be taken to about 120,000 polling units across Nigeria. Portability and power supply for PC are inevitable threats that will hinder the process of result management.

CHAPTER 4

4. SYSTEM DESIGN

4.2 Android Application

The design of the proposed android SMS application: the figure.7 bellow shows the layout view of the proposed android application.

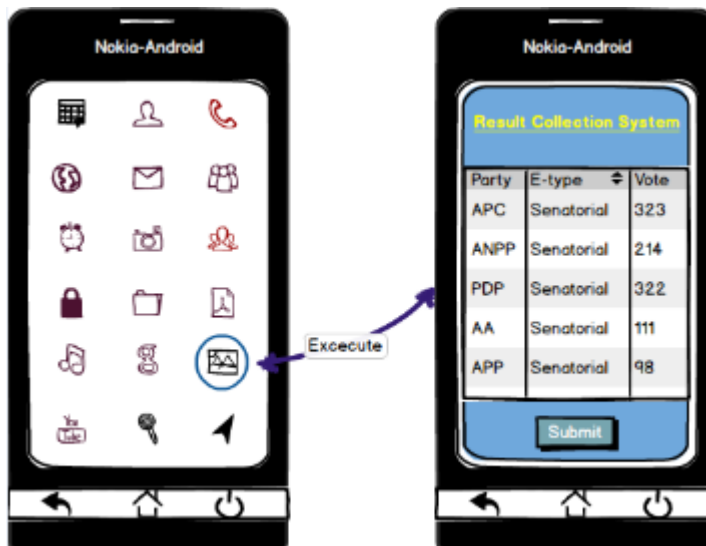


Fig. 7 Proposed android application

I used android Studio Android Development Toolkit (ADT) for the application development. The design procedure is as follow.

4.2.1 Algorithm to create android application (SMS application) with android studio

- Create an android project in android studio environment
- Edit the layout XML file to design a suitable user Interface for the application
- Switch to the java file and connect your components such as TextView, Button EditText, Spinner on the user interface to the java activity class after making the necessary imports (e.g. android.content.widget.Button), modify the java activity class file to perform the SMS transmission using android SMS manager.
- Modify android manifest.xml file to enable necessary permissions your application may be requesting from its users especially android send SMS permission.
- Effective application test should be made to prove its ability to send result through SMS in proper format.

The fig. 8 below shows the android studio environment for android application development.

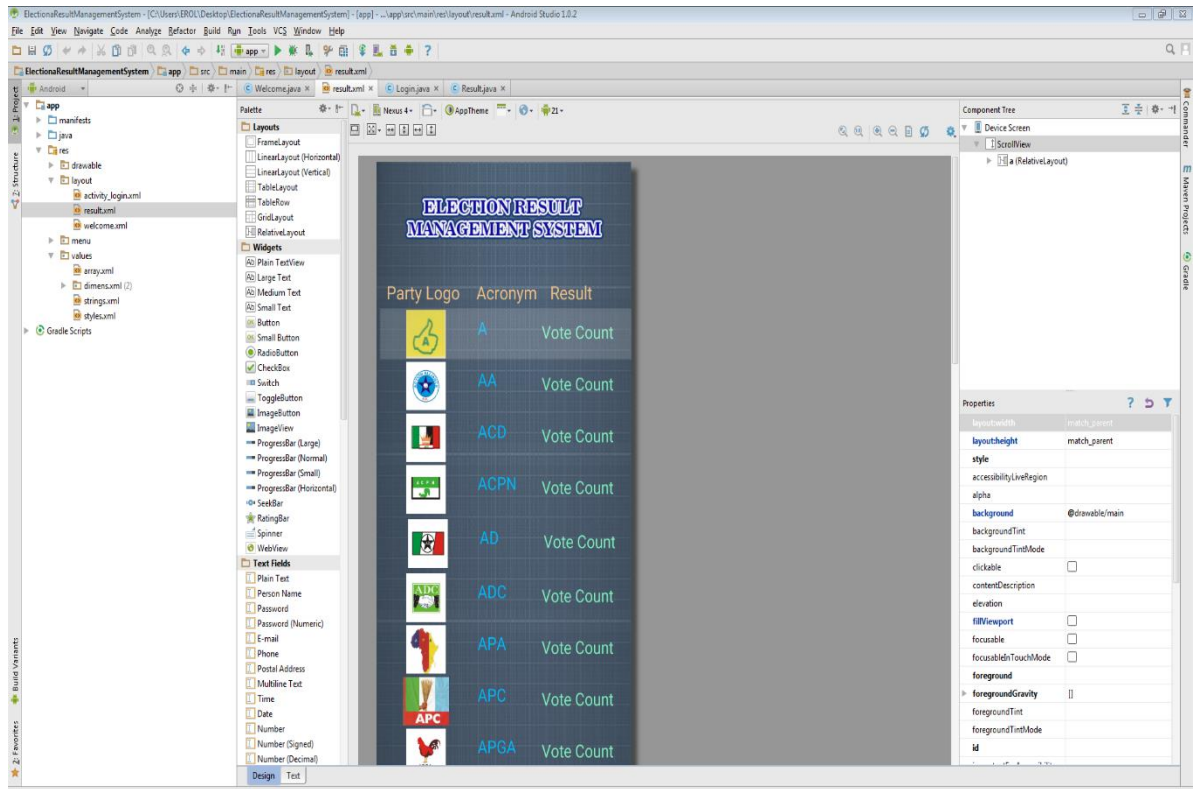


Fig.8 Android Studio Environment

4.3 SMS retrieval and formatting

This project intend to retrieve transmitted SMS files into database through the use of python scripts which is to run when an SMS is received and then read SMS content and write result tables to MySQL database in an already created database tables in wampserver. There was a major difficulty of finding a USB modem with readable SMS file so therefore, this functionality has been referred to further research and a new method is introduced in order to retrieve the SMS file.

MoboRobo is a PC application that allow access to SMS in android phones from a PC, this way the SMS files are copied as text file and imported directly into the database as a new result from a polling unit.

4.4 Result Database design

The following table are used with their structure as shown below:

Field Name	Type	Description	Attribute
ElectionID	Int(11)	Election identification	Primary Key
ElectionName	Varchar(100)	Type of election	
EectionDate	date	Date of election	
PartyId	Int(11)	ID of participating Party	Foreign Key

Table 4.1 Election Table

Field Name	Type	Description	Attribute
Candidate	Varchar(100)	Name of contestant	
ElectionType	Varchar(100)	Type of election Party participate in	
PartyName	Varchar(100)	Name of party	
PartyID	Int(11)	Identity of party	Primary Key
Gender	Varchar(100)	Gender of contestant	
Age	date	Age of contestant	
Qualification	Varchar(100)	Qualification of contestant	

Table 4.2 Party Table

Field Name	Type	Description	Attribute
State_Name	Varchar(20)	Name of state	
State_ID	Varchar(10)	Identity of state	
LGA_NAME	Varchar(20)	Name of LGA	
LGA_ID	Int(10)	Identity of LGA	
WARD_NAME	Varchar(20)	Name of Ward	
WARD_ID	Int(10)	Identity of Ward	
PU_NAME	Varchar(100)	Name of polling units	

PU_ID	Int(10)	Identity of polling units	Primary Key
-------	---------	---------------------------	-------------

Table 4.3 PU Table

Field Name	Type	Description	Attribute
PartyName	Varchar(100)	Name of party	
Votecount	Int(11)	Number of votes counted	
PU_ID	Int(11)	Identity of pollen unit	Foreign Key
PartyID	Int(11)	Identity of party	Primary Key

Table 4.4 Result Table

Field Name	Type	Description	Attribute
PU_Username	Varchar(25)	Name polling unit user	
PU_userID	Int(20)	Identity of polling unit user	Primary Key
PU_ID	Int(20)	Identity of polling unit	Foreign Key
PhoneNo	Int(20)	Phone number of pollen unit user	

Table 4.5 PU_User Table

Field Name	Type	Description	Attribute
Candidate	Varchar(100)	Name of candidate	
PartyName	Varchar(25)	Name of party	
Votecount	Int(20)	Vote earned	
Gender	Int(20)	Gender	

Table 4.6 Web Display View

The incoming election results are store in a result table and collation takes place as results accumulates, The Database has several tables like; PU-Result, PU-User, Party, Election, PU-delimitation, Web-display table for keeping other relevant information that may be needed to validate incoming results, compute final result, statistics of results, or display result on webpage.

4.5 Webpage Result display: fig. 9 below shows the interface of the proposed webpage for displaying results.

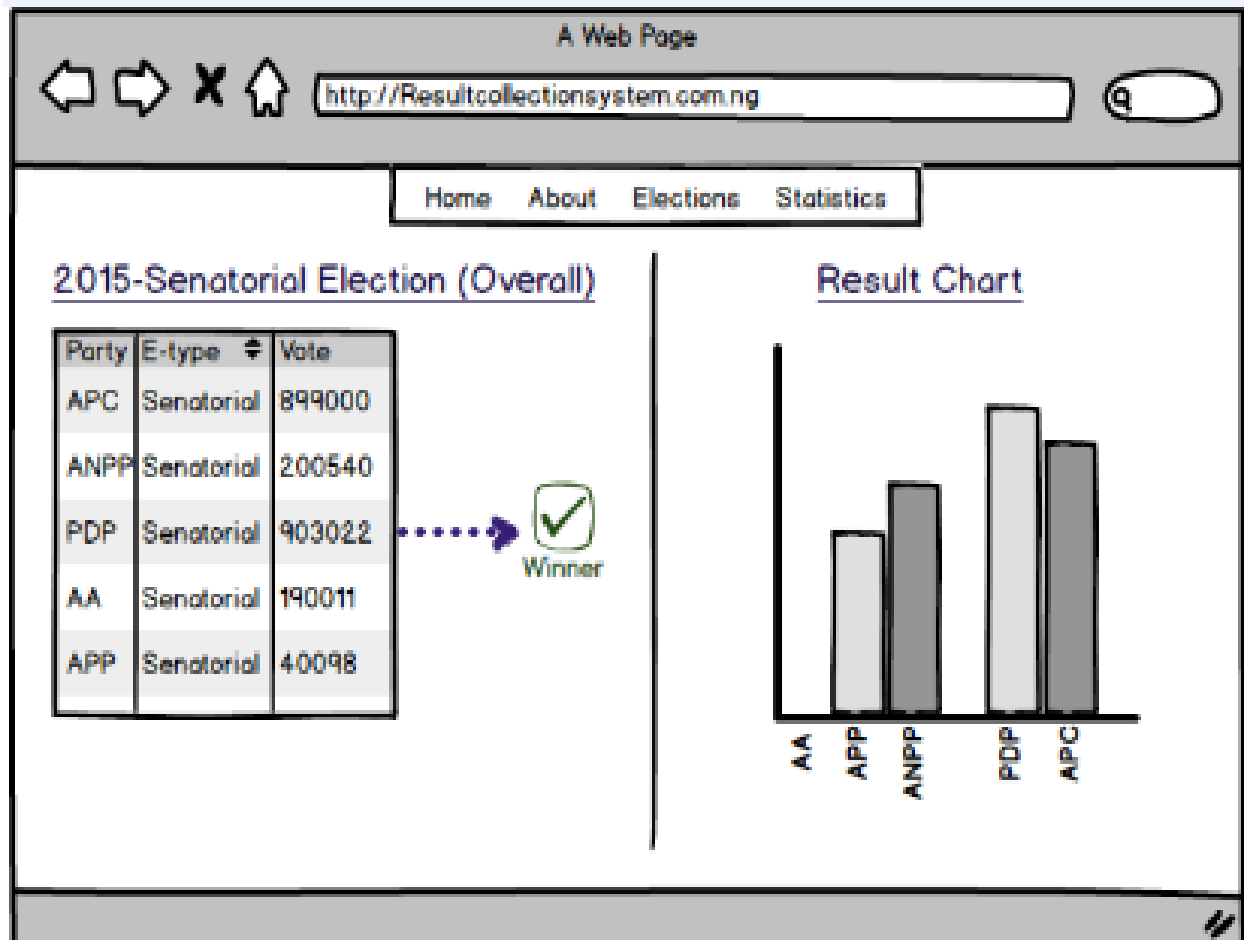


Fig. 9 The proposed website for result display

The webpage result display is the final step of the result management system and this is after necessary validation of the awaited result, in this project, we used wordpress for developing the local website where results are going to be displayed.

4.6 Input Screens: the various user interfaces provided to users for data input that will be used by the system or application in processing output result.

The fig 10 below shows the instruction page of the android application.

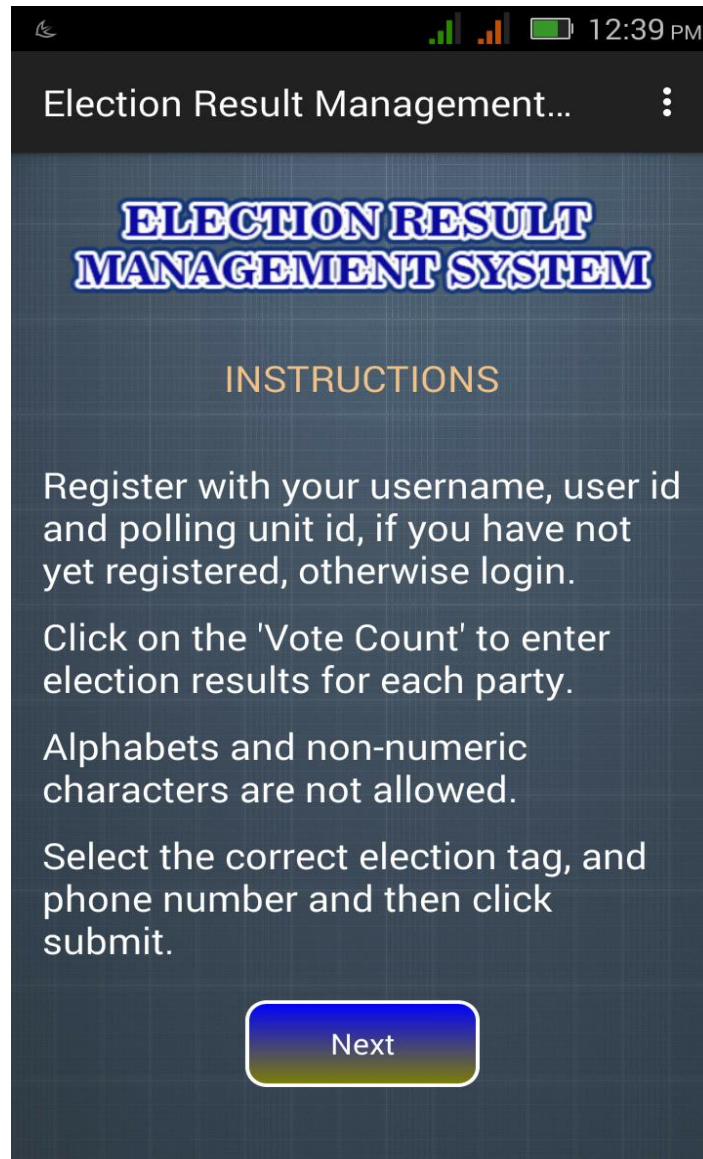
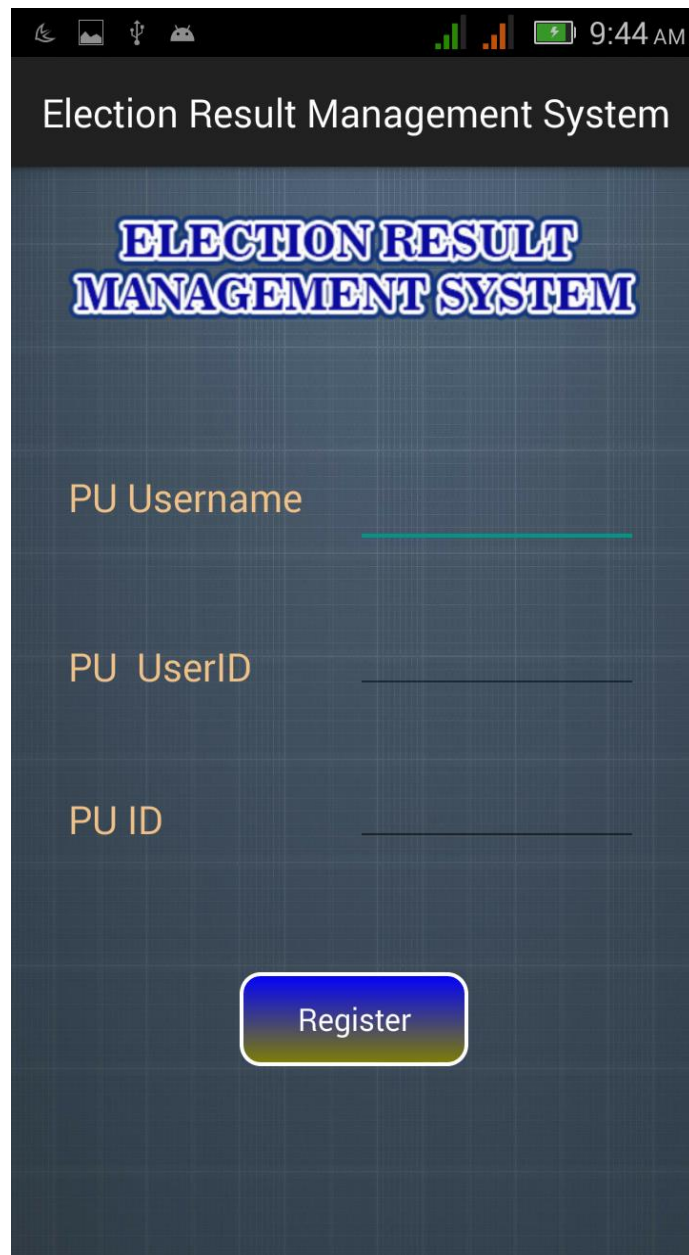


Fig. 10 Android SMS Application Instruction page

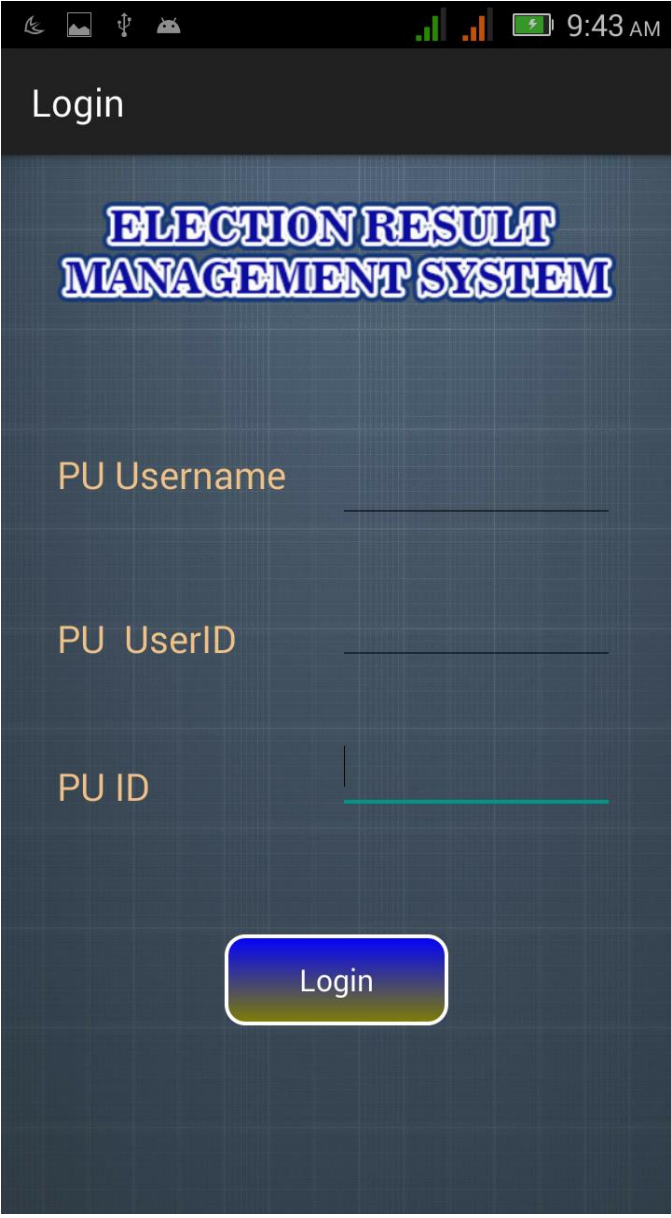
The fig. 11 below shows the Register page of the android application



The screenshot shows the 'Register' page of the 'Election Result Management System' on an Android device. The status bar at the top displays the time as 9:44 AM and various system icons. The app title 'Election Result Management System' is at the top of the screen. Below it, the title 'ELECTION RESULT MANAGEMENT SYSTEM' is displayed in a stylized, blue, outlined font. The registration form consists of three text input fields with labels in orange: 'PU Username', 'PU UserID', and 'PU ID'. Each field has a corresponding underline. At the bottom of the form is a blue button with a yellow-to-green gradient and the text 'Register' in white.

Fig.11 Android SMS Application Registration page for polling unit users

The fig. 12 below shows the Login page of the android application



The screenshot displays the login interface of an Android application. At the top, a black status bar shows standard Android icons (back, home, recent apps, USB, and battery) and the time 9:43 AM. Below this, a dark grey header bar contains the word "Login" in white. The main background is a dark blue grid pattern. Centered at the top is the title "ELECTION RESULT MANAGEMENT SYSTEM" in a large, blue, outlined, serif font. Below the title are three input fields, each with a label in orange text: "PU Username", "PU UserID", and "PU ID". Each label is followed by a horizontal input line. The "PU ID" line is highlighted with a green underline. At the bottom center is a rounded rectangular button with a blue-to-yellow gradient and the word "Login" in white.

Fig.12 Android SMS Application Login page for registered Polling unit users

The fig. 13 below shows the result form page of the android application

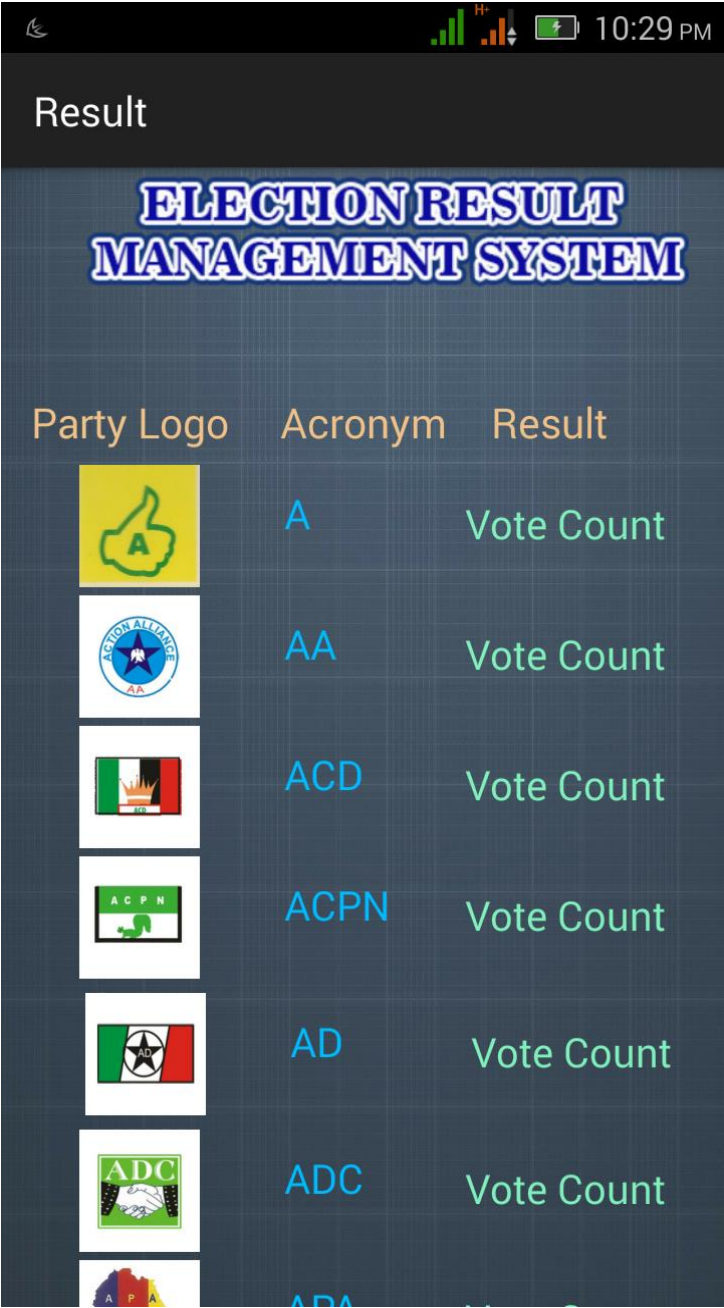


Fig.13 Android SMS Application result form-page for entering votes counted for each party

The fig. 14 below shows the Alert dialog from entering result of the android application

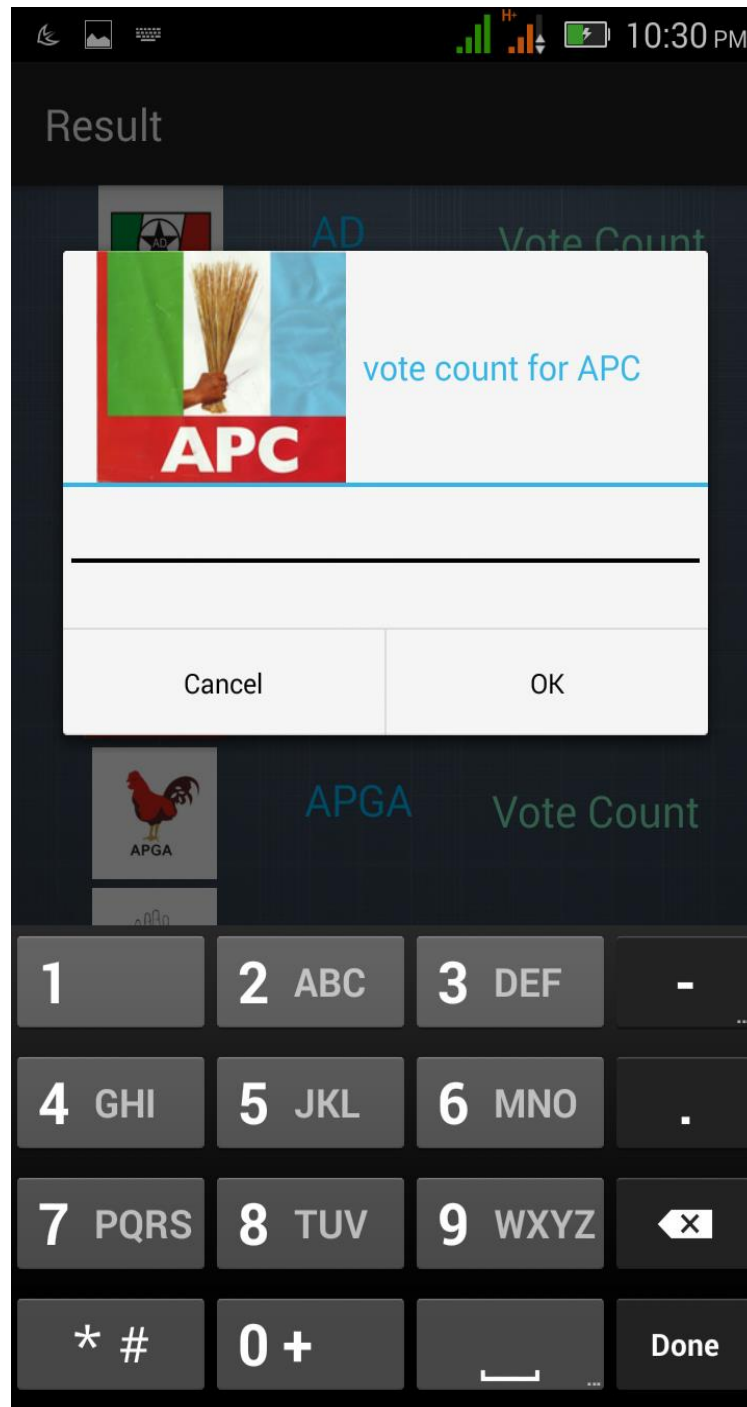


Fig.14 Android SMS Application result form-page showing a focus on a single political party with a dialog alert interface for the vote counted to be entered.

The fig. 15 below shows the list of election tag from android spinner.

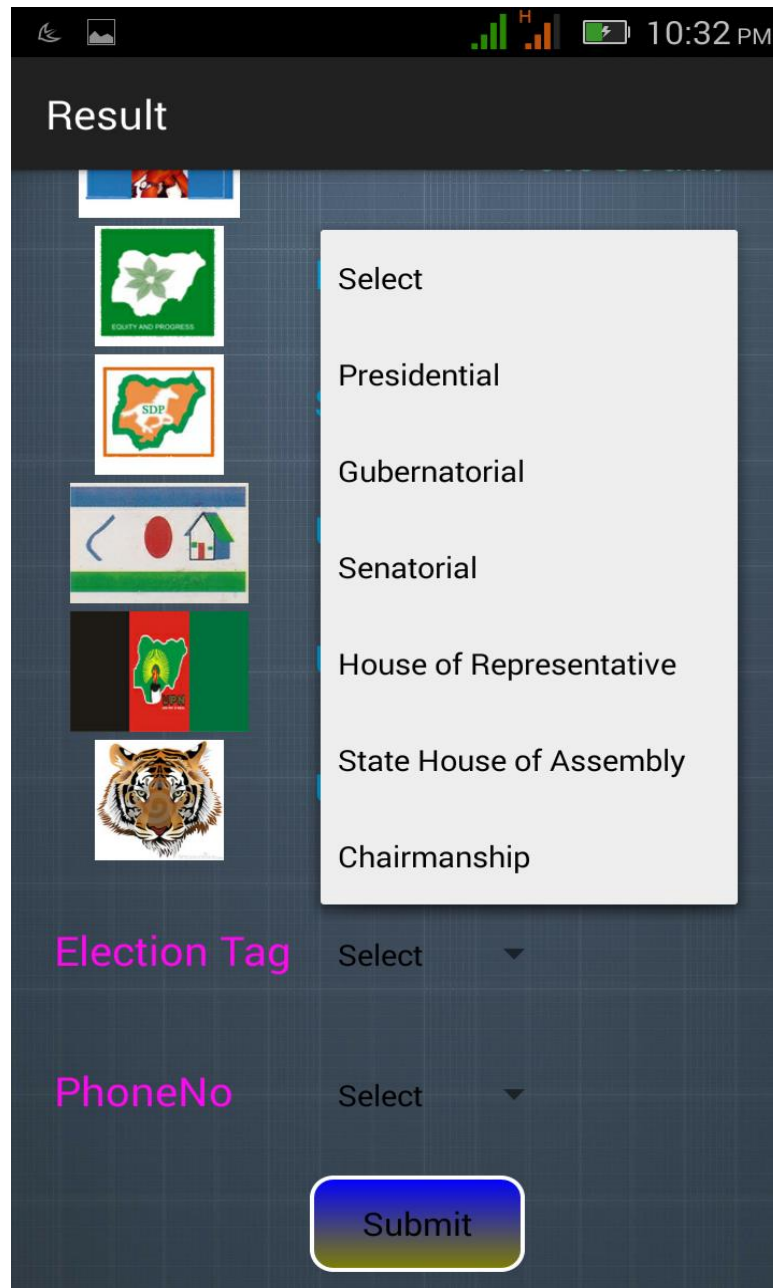


Fig.15 Android SMS Application result form-page showing how election types are selected before the results are sent as SMS

4.7 Output Screens: the user interfaces where processed user inputs are show in form of response or feedbacks.

The fig. 16 below shows Moborobo PC application user interface

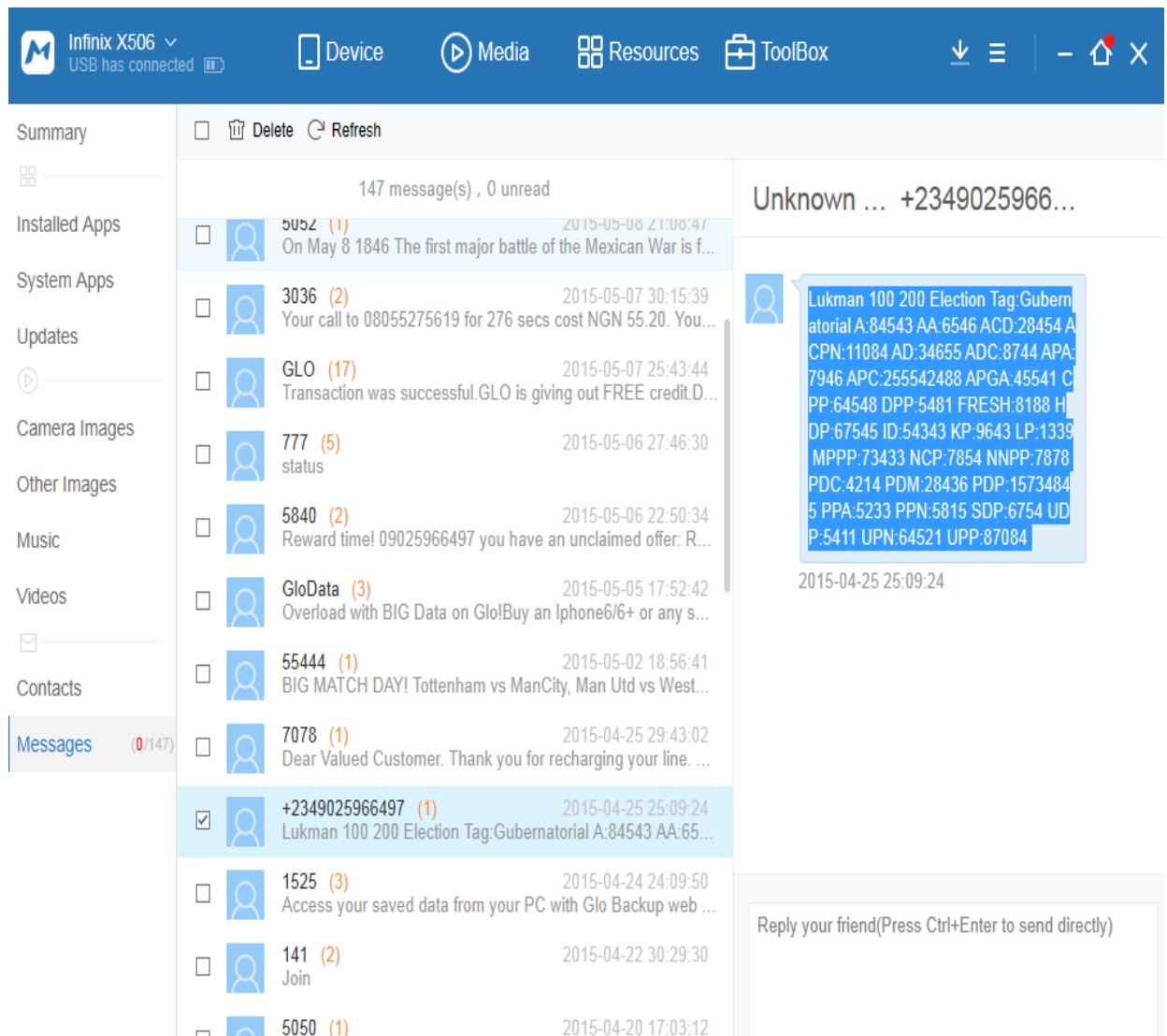


Fig.16 Moborobo application interface showing how SMS message sent from mobile applications are being retrieved before been saved into a txt file.

The fig. 17 below shows the database layout of the result database in phpmyadmin

The screenshot shows the phpMyAdmin interface for a database named 'electionresultmanagement'. The 'result' table is selected, and its structure is displayed. The table has four columns: PartyName, VoteCount, PU_ID, and PartyID. The data is sorted by PartyID in ascending order, showing 14 rows of results. The interface includes a sidebar with a database tree, a top navigation bar with various tools (Browse, Structure, SQL, Search, Insert, Export, Import, Operations, Empty, Drop), and a main area for displaying the table data.

	PartyName	VoteCount	PU_ID	PartyID
<input type="checkbox"/>	A	84543	1	1
<input type="checkbox"/>	AA	6546	2	2
<input type="checkbox"/>	ACD	28454	3	3
<input type="checkbox"/>	ACPN	11084	4	4
<input type="checkbox"/>	AD	34655	5	5
<input type="checkbox"/>	ADC	8744	6	6
<input type="checkbox"/>	APA	7946	7	7
<input type="checkbox"/>	APC	255542488	8	8
<input type="checkbox"/>	APGA	45541	9	9
<input type="checkbox"/>	CPP	64548	10	10
<input type="checkbox"/>	DPP	5481	11	11
<input type="checkbox"/>	FRESH	8188	12	12
<input type="checkbox"/>	HDP	67545	13	13
<input type="checkbox"/>	ID	54343	14	14

Fig.17 Database tables in phpmyadmin for collating election results sent from polling units.

The fig. 18 below shows the screen shot of the website for election result display

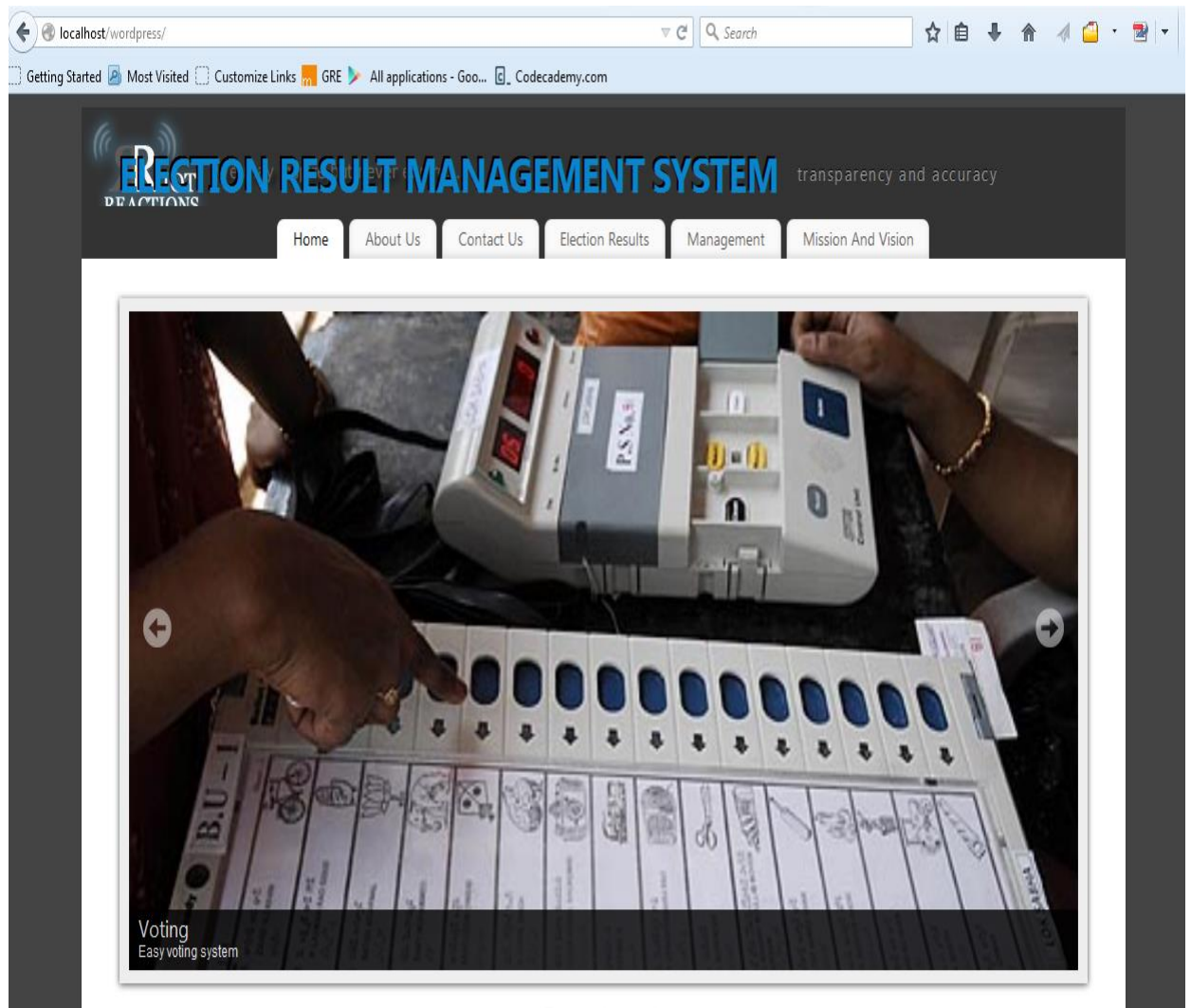


Fig.18 Website for result display.

The fig. 19 below shows the result display on a web page

PartyName	ElectionType	Vote Count
A	PRESIDENTIAL	84543
AA	PRESIDENTIAL	6546
ACD	PRESIDENTIAL	28454
ACPN	PRESIDENTIAL	11084
AD	PRESIDENTIAL	34655
ADC	PRESIDENTIAL	8744
APA	PRESIDENTIAL	7946
APC	PRESIDENTIAL	255542488
APGA	PRESIDENTIAL	45541
CPP	PRESIDENTIAL	64548
DPP	PRESIDENTIAL	5481
FRESH	PRESIDENTIAL	8188
HDP	PRESIDENTIAL	67545
ID	PRESIDENTIAL	54343

Fig.19 Final web display of election results.

CHAPTER 5

5. SYSTEM IMPLEMENTATION

5.1 System Application Development

An Android SMS application was designed for polling unit users to fill votes counted in an interface and then sent SMS at the polling units to a result collation center at the LGA or State collation center. This application is developed on run every android powered device (minimum API of 10 and target API of 21-Lollipop), which means about 95% available devices can use it including the very cheap android phones. Various functionalities were included in this application to ensure accurate result transmission, reduced error possibilities and enhances transparency in election result management.

5.2 Major Challenges and solutions

- Android SMS Application: There was string truncation issue of the SMS in the mobile application due to the fact that SMS messages are divided into parts of 160 characters each, so in a situation where the SMS message is more than 160 characters a runtime exception occur and the application crashes. The solution around this was to make use of the multipart function in android SMS manager which automatically sends the parts in situations where there are multiple part SMS message to be sent.

- USB modem: As part of the system plan of this project, SMS files are expected to be accessed by python script which read and write incoming SMS files that is assumed to be stored in modem installation file in program file, we tried to read the file suspected to be holding the incoming SMS (SMS.BA1 in program files),but it was unreadable to python code and when other text editors were tried, it was found that there is some form of protection for the SMS files by the device manufacturers to restrict unauthorized access, and we got similar feedback several from several other trials of USB modems from different manufacturers. Although, we have not been able to find a substitute method of getting SMS messages sent from the mobile application to the database without manual intervention, we were able to use pc application (Moborobo) to get the transmitted SMS and manually import it into the database.

- CSV file import: By default, importing CSV file into a database in PhpMyAdmin allows only 2MB and files bigger than this is impossible to import by any means. This was

had to admit because my PU-delimitation table was more than 7MB in CSV format and we needed to import it direction as it is very difficult to create table with about 120,000 rows. A way around this unfair restriction was to edit the php.ini file in my Wampserver configuration file, to change 2MB to 20MB which allows me to import the files I had found difficult to import.

5.3 System Maintenance: This project has been designed to trill in diverse environmental condition and this is only achieved through effective maintenance of the system.

Software update to the android application will be made if any software bug is discovered after the test, as it is impossible to make exhaustive test. This will be same for other aspects of the system.

More importantly, this system is subject to test before use for election result management, this can be done by sending results from different locations in Nigeria in order to ensure that the system will be effective during the time of actual use.

5.4 System Evaluation and Effectiveness analysis

Android SMS application

The figure below show the form format for android application usability test

Election Result Transmission and Collation System

Usability Test For android application to be used for election Result transmission through SMS

	Party Name(Acronym)	Vote Count
1	A	2918
2	AA	535
3	ACD	464
4	ACPN	944
5	AD	323
6	ADC	5634
7	APA	321
8	APC	987842
9	APGA	13
10	CPP	224
11	DPP	
12	FRESH	3345
13	HDP	
14	ID	2432443
15	KP	
16	LP	113
17	MPPP	77
18	NCP	434
19	NNPP	786
20	PDC	431
21	PDM	217
22	PDP	877543
23	PPA	
24	PPN	
25	SDP	
26	UDP	4454
27	UPN	
28	UPP	4666

OBJECTIVE	DEGREE TO WHICH IT IS MET
1. Accessibility to unauthorized users or non PU-users	90%
2. User input error prevention by application	98%
3. User control over the destination of the sent election results (SMS)	98%
4. Ability to send SMS in correct format without result mix-up	98%
5. Increase timeliness of election result delivery to final collation center	92%

Table. 7 Effectiveness analysis Table

CHAPTER 6

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Good governance has being a commodity that has consistently troubled under developing countries. Dictatorial governments have also consistently rigged elections by manipulating results. This project aim to eliminate result manipulation by reducing manual intervention to the minimum, in addition the time between voting and declaration of results will be reduced to the minimum, it is during this time that rigging takes place.

This project, if fully implemented successfully, will significantly promote transparency and accuracy of election results.

6.2 Further Application and System Recommendation

The design system is not limited to a specific type of election. In its maturity, it can also be used by organizations to carry out election with little modification of same underline system.

This system can easily be integrated with a full voting system (electronic voting system) where by voting and result management (transmission and collation) are been managed by one system.

6.3 Further Research Work

This project aimed to reduce manual intervention with election result to the minimum, so the use of an application (moborobo) to get election result from the phone introduce manual intervention. This system needs to be automated by using script to read SMS and write to database directly.

The effectiveness of this project depends greatly on efficient record keeping and this is only possible with database. Therefore the database design of this project has to be more sophisticated in order to suit variations in elections as well as allow results display to be more informative rather than just showing a single table.

In this project, we are sending SMS in plain text to a third party (Network provider) in form of SMS and the results may be modified. To overcome this, vulnerability, SMS messages

should be encrypted before being sent, and decrypted by scripts before they are added to database.

BIBLIOGRAPHY

1. "Pre-Independence Method of Election". Tamil Nadu State Election Commission, India. Retrieved 3 November 2011.
2. Headlam, James Wycliffe (1891). Election by Lot at Athens. p. 12.
3. Farquharson, Robin. 1969. *A Theory of Voting*. New Haven, CT: Yale University Press.
4. Riker, William. 1980. *Liberalism against Populism: A Confrontation between the Theory of Democracy and the Theory of Social Choice*. Prospect Heights, IL: Waveland Press.
5. Thompson, Dennis F. 2004. *Just Elections: Creating a Fair Electoral Process in the U.S.* Chicago: University of Chicago Press. ISBN 978-0226797649
6. Ware, Alan. 1987. *Citizens, Parties and the State*. Princeton: Princeton University Press.
7. Riera A; Sanchez J and Tonas .L. (2002): Internet voting: Embracing Technology in Electoral processes, Electronic Govt: Design Application and Management; Idea Grp publishing Lofedo;
8. Oostveen .A.M. and Bessdaar P.V. (2009): Users Experiences with E-voting: A comparative case study; J of Electronic Governance, vol.2, No 4,
9. Benaloh, J. and Tuinstra, D. (1994) "Receipt-free Secret-Ballot Elections", In Proceedings of the 26th ACM Symposium on Theory of Computing (STOC'94), Montreal, Canada, 544-553.
10. Fujioka, A., Okamoto, T. and Ohta, K.(1992) "A Practical Secret Voting Scheme
11. Keller A.M., Dechert, A., Auerbach, K, Mertz, D; Pearl, A and Hall, J.L.(2005) "A PC-based Open – Source Voting Machine with an Accessible Voter-Verifiable Paper Ballot," Proceedings of the USENIX Annual Technical Conference, U.S.A.
12. Mercuri .R., "A Better Ballot Box?" (2002) IEEE spectrum, 39, 10, 46-56.
13. Schaupp C.C, and Carter L. (2005): "E-voting: from apathy to adoption", J of Enterprise info. Mgt. vol and iss:5,
14. Institute Policy (2000): "Report of the National Workshop on Internet Voting: Issues and Research Agenda,

15. Kuye C.O; Coker J.O; Ogundeinde I.A and Coker C.A. Design and Analysis of Electronic Voting System in Nigeria. Int. Arch. App. Sci. Technol., Vol 4 [2] June 2013: 15-20
16. Cabri, G., Leonardi, L., Reggiani, G. and Zambonelli, F. (1999), "*Design and Implementation of a Programmable Coordination Architecture for Mobile Agents*", Proceedings of the TOOLS EUROPE '99 Conference, Nancy (F), June.
17. Marthie S. and Elsabe C. (2003), "*Architectural Components for the Efficient Design of Mobile Agent Systems*" *Proceedings of SAICSIT 2003*, pp. 48-58.
18. Baldi M., Gai S. and Picco G.P. (1998), "Evaluating the Tradeoffs of Mobile Code paradigms in Network Management Applications", Proceedings of the 20th international Conference on Software (ICSE'98), April, Kyoto, Japan, pp. 146-155
19. Edgeworth, Linda et al, Election Official Training in Bangladesh: Project Overview and Recommendations, October-November 1995, Country reports, Washington, DC: IFES, 1995.
20. Elections Canada. Compendium of Canadian Electoral Legislation. Ottawa: 1996
21. Electoral Commission of India. Procedures of Counting of Votes by Mixing of Ballot Papers - Revised Instruction. New Delhi: 1996.
22. Federal Election Commission. The Electronic Transmission of Electoral Materials. Innovation in Election Administration N 12, Washington, DC: 1995.
23. Raynolds, Andrew, and Ben Reilly. The International IDEA Handbook of Electoral System Design. Stockholm: International IDEA, 1997.
24. Encyclopaedia of Islam and the Muslim World (2004), vol. 1, p. 116-123.

APPENDIX A

IMPORTANT CODE SNIPPETS

Sending SMS in the Android Application

```
private void sendSMS(String phoneNo, String message) {

    SmsManager sms1 = SmsManager.getDefault();

    ArrayList<String> parts= sms1.divideMessage(message);

    int numParts = parts.size();

    String SENT = "SMS_SENT";

    String DELIVERED = "SMS_DELIVERED";

    ArrayList<PendingIntent> sentIntents = new ArrayList<PendingIntent>();

    ArrayList<PendingIntent> deliveryIntents = new ArrayList<PendingIntent>();

    for (int i = 0; i < numParts; i++) {

        sentIntents.add(PendingIntent.getBroadcast(this, 0, new Intent(SENT), 0));

        deliveryIntents.add(PendingIntent.getBroadcast(this, 0, new
        Intent(DELIVERED), 0));

    }

    //---when the SMS has been sent---

    registerReceiver(new BroadcastReceiver() {

        @Override

        public void onReceive(Context arg0, Intent arg1) {

            switch (getResultCode()) {

                case Activity.RESULT_OK:

                    Toast.makeText(getBaseContext(), "SMS sent",

                        Toast.LENGTH_SHORT).show();

                    break;

                case SmsManager.RESULT_ERROR_GENERIC_FAILURE:
```

```

        Toast.makeText(getBaseContext(), "Generic failure",
                        Toast.LENGTH_SHORT).show();

        break;

    case SmsManager.RESULT_ERROR_NO_SERVICE:

        Toast.makeText(getBaseContext(), "No service",
                        Toast.LENGTH_SHORT).show();

        break;

    case SmsManager.RESULT_ERROR_NULL_PDU:

        Toast.makeText(getBaseContext(), "Null PDU",
                        Toast.LENGTH_SHORT).show();

        break;

    case SmsManager.RESULT_ERROR_RADIO_OFF:

        Toast.makeText(getBaseContext(), "Radio off",
                        Toast.LENGTH_SHORT).show();

        break;

    } }

}, new IntentFilter(SENT));

//---when the SMS has been delivered---

registerReceiver(new BroadcastReceiver() {

    @Override

    public void onReceive(Context arg0, Intent arg1) {

        switch (getResultCode()) {

            case Activity.RESULT_OK:

                Toast.makeText(getBaseContext(), "SMS delivered",
                                Toast.LENGTH_SHORT).show();

                break;

            case Activity.RESULT_CANCELED:

                Toast.makeText(getBaseContext(), "SMS not delivered",

```

```

        Toast.LENGTH_SHORT).show();

        break;

    } }

    }, new IntentFilter(DELIVERED));

    sms1.sendMultipartTextMessage(fone, null, parts, sentIntents,
    deliveryIntents);

    }}

```

Creating MySQL table

```

CREATE TABLE `electionresultmanagement`.`result` ( `PartyName` varchar( 100 )
NOT NULL ,

`VoteCount` int( 11 ) NOT NULL ,

`PU_ID` int( 11 ) NOT NULL DEFAULT '1',

`PartyID` int( 11 ) NOT NULL AUTO_INCREMENT ,

PRIMARY KEY ( `PartyID` )

) ENGINE = MyISAM DEFAULT CHARSET = latin1;

```

Collecting results from MySQL table to the webpage with PHP

```

<?PHP

while ($results=mysql_fetch_assoc(records)) {

    echo "<tr>";

    echo "<td>".$result['PartyName']. "</td>";

    echo "<td>".$result['VoteCount']. "</td>";

    echo "<td>".$result['PU_ID']. "</td>";

    echo "<td>".$result['PartyID']. "</td>";

    echo "<tr>";

}

?>

```

