

DESIGN SPECIFICATION FOR AN ONLINE VOTING SYSTEM

**CASE STUDY: UGANDA ELECTORAL
COMMISSION**

BY

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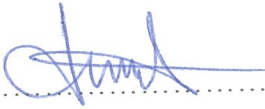
**A Graduation Project Proposal Submitted to the School of Computer
Studies In partial fulfillment of the requirements for the award of
Degree of Bachelor of Computer Science of Kampala
International University**

NOV, 2009

DECLARATION

We, **SAKWA JOEL INZOVERI** and **MANISOOR RHEMA** do hereby declare to the best of our knowledge that this graduation project is our original work and that it has never been submitted any university or any other institution. The literature and citations from other people's work have been duly referenced and acknowledged in text, footnotes and bibliography.

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Date: 5/10/2009

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Mr. MUTAASA AHMED.

Supervisor.

Dedication

I dedicate this thesis work to my Parents, My friends for their support and prayers, my sister and brother for their unconditional love, support and care for me.

Sakwa Joel Inzoveri

I dedicate this thesis work to my Mother, my dad Mr. Kasiita John who is my guardian and my whole family for all their love and support during this hard thesis work and the role they have played in my achievement academically.

Manisoor Rhema

APPROVAL

This Graduation project has been submitted with the approval of the following supervisor.

Signed.....

Date.....

Mr. Mutaasa Ahmed

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ACKNOWLEDGEMENT

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Finally, our greatest appreciation and love goes to our families and for sure this would not have happened without their unconditional love, care and support.

Kampala International University, April
2008
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Rhema

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ABBREVIATION

Terms Used

E-Government

E-Government is the use of technology to enhance the access to and delivery of government services to benefit citizens, business partners and employees. For instance to e-government in Uganda.

E-Governance

E-Governance is the use of ICT by different actors of the society with the aim to improve their access to information and to build their capacities.

E-Democracy

It is neologism and contraction of electronic democracy, is the utilization of electronic communication technologies, such as the internet, in enhancing democratic processes within a democratic republic or representative democracy. It is a political development still in its infancy, as well as the subject of much debate and activity within government, civic oriented groups and societies around the world.

E-voting

E-voting combines technology with democratic process, in order to make voting more efficient and convenient for voters. E-voting (or electronic voting) allows voters to either vote by computer from their homes or at the polling station.

E-voting machines (E-voting at the polling booth)

This form of e-voting is virtually the same as regular voting, but replaces the ballot paper with electronic voting machines. These Electronic machines are backed by some computer chips to store data (votes in this case) and can be retrieved when connected to the main network.

E-move

In this time of developing age when everything is being affected by the computers and their being digital, e-move is when services establish themselves from manual to the electronic way of handling. Or more specifically in our research work we would say the transformation of paper based voting into electronic way is to be known as e-move of the voting system itself.

ACRONYMS.

EVM: Electronic Voting Machines

ECI: Election Commission of India

EAC: Election Assistance Commission

ICT: Information and Communication Technology

UN: United Nations

ESD: Election Service Delivery

OECD: Organization for Economic Co-operation and Development

TAM: Technology Acceptance Model

TPB: Theory of Planned Behavior

VAT: Value Added Tax

ACT: Australian Capital Authority

BEL: Bharat Electronics Limited

ECIL: Electronics Corporation of India Limited

LED: Lighting Emitting Diode

ID: Identity Card

CNIC: Computerized National Identity Card

NADRA: National Database and Registration Authority

LCD: Liquid Crystal display

GDP: Gross Domestic Product

PCMCIA: Personal Computer Memory Card international Association

GUI: Graphical User Interface

GEMS: Gene Expression Mining Server

PIN: Personal Identification Number

UI: User Interface.

ABSTRACT

When we see today's world, e-government has played an enormous role in the advancement of the services provided by the governments worldwide. Today each and every country is giving e-governance a go. There are different levels of implementation of the e-governance worldwide but it is more of an interest to find out this in the developing world. Pakistan is one the emerging countries in the world which is trying to make a difference in the developed world and is implementing e-government at an enormous rate.

Hereby; we tried to find out what are the current issues as obstacles towards e-democracy and have tried to figure out what are the factors and measures the government should take to have e-voting as an electoral procedure rather than going through the previous traditional way of manual handling of the elections in which we see controversies.

This research work is of more importance at this stage as Uganda is reaching its election period and Government would be in need of such work to get hands on this through a fast and secure electoral process.

Keywords: Uganda, e-Government, e-democracy, e-voting, elections, EVM, Diebold.

CHAPTER ONE

1.0 PROJECT OVERVIEW

1.1 Introduction.

Uganda has always had problems in its electoral process where its own people hardly believe in the electoral system. In a general perspective most African countries have almost the same problem in the electoral bodies and thus some thing is bound to be done so as to improve the electoral system of the respective countries.

Although, voting systems and protocols have improved since the 1980s, more has to be done to improve their accuracy, reliability, efficiency and security, as well as accessibility and trustworthiness. Paper ballots are subject to loss and may be corrupted in various ways, including accidental or malicious over-voting. Additionally, paper ballots must be securely transported and counted, activities which tend to make the election process slow, labor intensive and costly. Paper ballots also have significant usability limitations which make them generally less accessible to voters who are not comfortable with the languages available at the polling station, voters who are illiterate and voters who are vision impaired or have other disabilities. Many such voters require assistance which compromises their privacy and their trust that their vote was cast as intended.

Therefore, Uganda was in need of such a system where people can vote without any problem and feel secure and no one can manipulate the results and if there are problems then they are at the minimal level. Such environment can be created through some automated system which can take less time, no paper work and less rigging.

1.2 Statement of the problem.

Uganda Electoral Commission as a body has many problems with the existing system of voting and yet the institution does want to give the people what they really want and the correct information. These problems are brought up by the paper ballot system which is used or voting and the system consumes a lot of time, easily manipulated and difficult to track. Therefore it has led to a lot of disagreement and difficulties in accepting the results announced as true and fair by the people. Thus the need of a better system to improve on the services the institution is to give the people of Uganda which is an Electronic voting system.

Objective of project:

1.3.1 Main Objective/ aim of the project:

Build a highly user friendly and interactive website hosting an online voting system with reliable database, highly responsiveness, security and quality content to replace the existing manual balloting which has proved to be unreliable and easily regularized.

1.3.2 Specific Objectives

1. Design the specifications of an online voting system in terms of its architecture, user interface and data Management.
2. Understand the user and general requirements for online voting system so as to satisfy the existing problem of manual voting domain in detail.
3. To design requirements for a future comprehensive user friendly, reliable and interactive voting website using Macromedia, flash, dream weaver and PHP codes.
4. Design specifications for database with MYSQL that will be reliable and dynamic.
5. Document all project from planning, analysis to design phases of the project and compile the project report.

1.3. 3 Research Question.

1. Is it possible to design a highly user friendly and interactive online voting system with a remote website as an interface hosted on a reliable response, secure and manageable database that solve vote rigging, cumbersomeness of the manual voting system and restore confidence in voters?
2. Is it possible to produce documented analysis that can help IT professionals ,governments, voters and other stakeholders understand key design and implementation issues in IT and democratic institutional alignments so as to be able to control or manage the proper use of technology in the organization?
3. Based on the effectiveness of currently employed variants of e-voting what factors can make e-voting a success in Uganda?

1.4 Scope of the project.

This project confined itself to democratic electoral process at national level within the territories of the republic of Uganda. It analyzed the key issues of democratization of a country, IT and IS technology contribution to this democratization phenomenon and how developing countries such as Uganda can benefit from online voting process that is rapidly replacing manual balloting.

The execution of this project was limited to planning, analysis, design of “online voting” on a website. A prototype of the system was produced with an implementation plan.

1.5 Significance of the study.

The implementation of the designs specified in this study was meant to raise awareness among electorates of Uganda, members of the society of East African Community, leaders, social technocrats, governments and the entire African continent groping to be an epitome of Democracy. In addition, it will help restore lost confidence in electoral systems in Uganda, save costs due to automated systems, save time of counting manual ballots, reduce government's expenditure on returning officers and also make available new technology that will see Uganda competing effectively on the democratic arenas like India and USA.

1.6 Justification of the Study.

Our study was aimed at automating the electoral process in Uganda. This enhances security of the electorate's ballot, ensures it goes to right candidate of their choice and what of the majority rules is passed as a true reflection on the ground. This is justified since it comes in a time when Uganda is preparing for elections in 2011. This is study meant to reduce costs, time, and energy and automate the electoral process for faster effective elections for Uganda. This is what the Ugandan people need and thus our study's justification

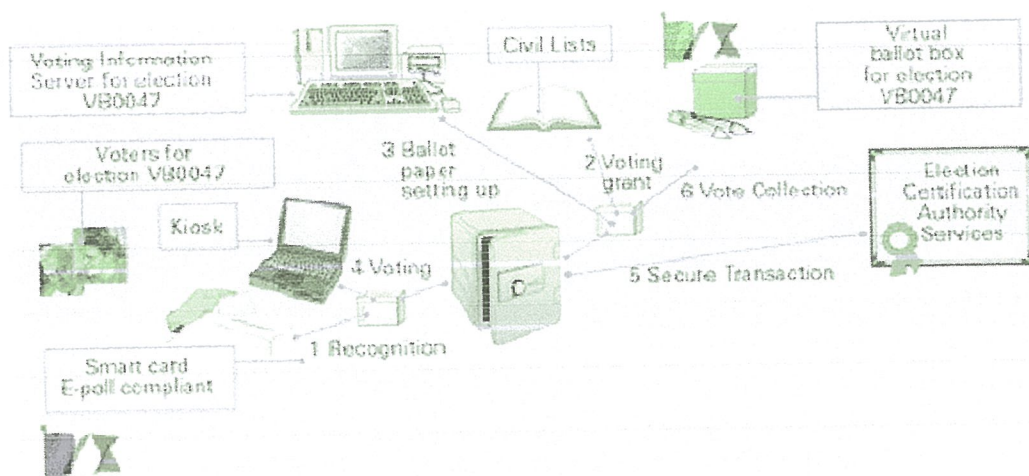
1.7 Conceptual Frame work.

The whole concept about this system lies on the specific online or remote E-voting mechanism namely; the polling station/ net interface that should request for user information or identifications that are uniquely stored on the database for approval and their validity vetted out before being allowed to go to the next web page for voting. The system will also show to what number the current votes are to a specific candidate of their choice and show this information both graphically (pictorial) and in figures. Behind the scenes, the following should be the phases of the system

- A website written in macromedia/PHP for user interface
- A web server for browsing through the web pages
- A php Engine for creating dynamic web pages.
- A Mysql server for browsing through the database.
- A reliable and expandable database.



OVERVIEW OF THE CONCEPTION FRAME WORK FOR DATA FLOW.



The overall conceptual framework of the voting system.

1. 8 Conclusion.

This chapter concludes by acknowledging the different stakeholders involved on its completion. It has presented the typical insight of what needed to be done at the end of the project. The following chapter will hence discuss the literature review that needed to be carried out during this research work.

CHAPTER TWO

2.0 LITERATURE REVIEW

1 Introduction:

This chapter gives the appraisal of the extent to which the literature review helped us in the research, how it addressed the problems we are handled and produces its theoretical framework for my project

The online voting processing system is *system* that is used to handle the voters balloting process which is intended to replace the manual process in Uganda. It involves having a secured user interface inform of a website that is dynamically driven by server side pHP language, network that is effective and of high bandwidth and reliable databases build on a *mysql* platform.

2.1.1 System defined:

According to **Silberschtz Korth Sudaisham** in his book “*Database System Concepts*, 4th edition”, he defines a system as a collection of components that react with one another and operate together to achieved a goal /purpose. The components include inputs, process output and feedbacks
The proposed project will be used based from a thorough library research, internet, documental analysis, e-government, e-democracy, workshops and government forums to verify how the project will be according to the previous studies.

2.2. Fact finding techniques

2.2.1 Questionnaires

Kevin D. Dittman defines questionnaires as special purpose documents that allow the researcher to collect information and opinions from respondents whereby the document can be mass produced and distributed to respondents who can complete the questionnaires at their own time.

Questionnaires are useful in gathering information from large groups of people when the interviewer can not get around with interviewing everyone. Questionnaires may also yield more information if respondents remain anonymous in addition; this tool is convenient, inexpensive and yields a lot of data. However in this project, questionnaires will be used as one of the fact finding tools because they can be answered quickly and the respondents can complete and return questionnaires at their convenience and also the responses can be quickly tabulated and analyzed.

According to *Jeffrey L. Whitten* and others, they have agreed on collecting facts by using questionnaires as “the use of questionnaires has been heavily criticized and is often avoided by systems analyst. Many systems analysts claim that the responses lack reliable and useful

information and my opinion; questionnaires can be a useful tool in gathering very sensitive and confidential data.

Questionnaire is to be prepared and to be given to sample of the staff members of electoral commission, IT managers, Member of Parliament of Uganda, Guild members, businessmen, scholars and the general public to answer them and respond accordingly. Some of the questionnaire will be attached at the end of the report.

Jeffrey L. Whitten also recommended the following *merits* of questionnaires:

1. Most questionnaires can be answered quickly; people can complete and return questionnaires at their convenience.
2. Questionnaires provide a relatively inexpensive means for gathering data from a large number of individuals.
3. Questionnaires allow individuals to maintain anonymity; therefore individuals are more likely to provide the real facts rather than telling you what they think their boss would want them to.
4. Responses can be tabulated and analyzed quickly.

Questionnaires have the following *demerits*:

1. There's no guarantee that an individual will answer or expand on all the questions.
2. Questionnaires tend to be inflexible. There's no opportunity for the systems analyst to obtain voluntary information from individuals or to reword questions that may have been misinterpreted.
3. It's not possible for the systems analyst to observe and analyze the respondent's body language.
4. There is no immediate opportunity to clarify a vague or incomplete answer to any question.
5. Costly, good questionnaires are difficult to prepare.

2.2.2 Interviews

In his book '*System Analysis and Design*' Lonnie defines an interview as a fact finding technique where the researcher collects information from individuals through face to face interaction.

However Sawyer (2000) argues that interviews give the researcher an opportunity to motivate the interviewee to respond freely to questions. By establishing rapport, the researcher is able to give the interviewee a feeling of actively contributing to the project. Interviews also allow the researcher probe for more feedback from the interviewee.

Jeffrey L. Whitten and others comment that “No other fact-finding technique places as much emphasis on people as interviews, but people have different values, priorities, opinions, motivations and personalities. Therefore, to use the interviewing technique, you must possess good human relations skills for dealing effectively with different types of people like other fact-finding techniques, interviewing is not the best method for all situations. Interviewing has its advantages and disadvantages, which should be weighted against those of other fact finding techniques.’

Merits of interviews:

1. Interviews give the analyst an opportunity to motivate the interviewee to respond freely and openly to questions.
2. By establishing rapport, the systems analyst is able to give the interviewee a feeling of actively contributing to the systems project.
3. Interviews allow the systems analyst to probe for more feedback from the interviewee.
4. Interviews permit the systems analyst to adopt or reword questions for each individual.
5. Interviews give the analyst an opportunity to observe the interviewee's non verbal communication.

Demerits of Interviews:

1. Interviewing is a very time-consuming and therefore costly, fact-finding approach.
2. Success of interviews is highly dependent on the systems analyst's human relation skills.
3. Interviewing may be impractical due to the location of interviewees.

2.2.3 Observation:

This is owed to the fact that Observation is an ideal mode of data collection since it gives first hand information and not just secondary data. *Kevin D. Dittman (Systems Analysis and Design page 32)*

Merits of observation:

1. There is first hand information to be collected.
2. The information collected is less prone to bias.
3. The actual processes are witnessed.
4. Proper measurements can be collected and changes clarified.

Demerits of Observation

1. The researcher may be affected by emotions due to human nature
2. Some complex process can not be understood and thus resulting in poor documentation.

System development methodology.

According to “*Systems Analysis and Design Methods, 5th Edition*” by Jeffrey L. Whitten, Lonnie D. Bentley, Kevin C. Dittman describes Systems development methodology as a standard process followed in an organization to conduct all the necessary transitions and to analyze design, implement, and maintain information system.

We proposed to use SDLC (System Development Life Cycle) as our systems development methodology. SDLC is the traditional methodology used to develop, maintain, and replace Information system.

Software is the most obvious and product of the life cycle other essential outputs include documentation about the system and how it was developed as well as training for users each phases in SDLC has specific outcomes and deliverables that feed important information to other phases. We have derived the following under SDLC:

i. Project Identification and Selection:

This is the first phase of the SDLC in which an organization total information system needs are identified, analyzed, prioritized and arranged. We therefore identified the Online voting system as my project.

ii. Project Initiation and Planning:

This is the second phase of the SDLC, in which a potential information systems project is ex-planned and an argument for continuing or not continuing with the project is presented; a detailed plan is also developed for conducting the remaining phases of the SDLC for the proposed systems.

iii. Analysis:

This was carried out to determine whether the new system to be built would be feasible in terms of technicality and economically with the available resource. We have therefore embarked on substantial analysis and observed the current result handling system which is manual and thus vitalized the need for an automated online result handling system which will handle the backload:

iv. Design

The fourth of the SDLC in which the description of the recommended solution was converted into logical and then physical system specifications.

(a). Logical design

The part of the design phase of the SDLC in which all fundamental features of the system for development in analysis are described independently of any computer platform.

(b). Physical design

This refers part of the design phase of the SDLC in which the logical specifications of the systems from logical design are transformed into tech specific details from which all programming and system construction can be accomplished.

vii. Implementation

This is the fifth phase of the SDLC in which the information system should be coded, tested, installed and supported in the organization.

viii. Maintenance

This refers to the final phase of the SDLC in which an Information System should be systematically repaired and improved. We wish to repair and maintain the system at this phase having undergone a successful implementation.

2.3. 1 Unified Model Language (UML)

According to **Jeffrey L. Whitten, Lonnie D. Bentley and Kevin C. Ditten** [System Analysis and Design Methods, 5th Edition] UML is a set of modeling conventions that is used to specify or describe a software system in terms of objects. UML does not prescribe a method for developing systems.

The four general activities performed with UML technique were:

1. Modeling the functions of the system.
2. Finding and identifying the business objectives.
3. Organizing the objects and identifying their relationships
4. Modeling the behavior of objects.

2.4 Conclusion

This chapter has extensively reviewed all the aspect that the researchers used in achieving the goals and aims of this research work. We have chosen some aspect of development tools and left out others with reasons that best suit the successful completion of this project.

The next chapter will discuss the methodologies used achieving this project.

CHAPTER THREE

3.0 METHODOLOGY

Introduction:

Development methodology is a collection of methods one or more for every activity within every phase of a systems development project. The primary function of a development methodology is to provide discipline in the entire development process. A good development methodology will establish organization-wide standards for requirements gathering, design, programming and testing.

The aim of this chapter will be to give an introduction about the general research methodology used in this study together with specific tools used in data collection and analysis. Also this chapter will be discussing the methods to evaluate validity and reliability of the research.

Methodology overview

The researchers followed the fundamental phases of the system development life cycle (SDLC); planning, analysis, design and implementation. In the planning phase the researchers identified the scope of the problem and plan the development strategy and goals and the systems benefit to the Uganda. In the analysis phase the researchers studied and analyzed the problems, causes and effects of the current system then identify and analyzed the requirements that must be fulfilled by any successful solution.

In the Design phase, the researchers designed the solution and developed a physical design, architecture design, and interface design, database and file specifications. Finally in the implementation phase the researchers left it out for further studies as this was not part of the scope of this research work. The researcher analyzed the implemented solution in passive to refine the design and implement to the solution.

Project Plan.

3.3.1 Purpose of this Plan

Following the proposal that led to development of this project report, this project plan has delved in trying to meet the standards set in the initial proposal of this report. This has focused mainly in:

- Project purpose
- Business and project goals and objectives
- Scope and expectations
- Roles and responsibilities
- Assumptions and constraints
- Project management approach
- Ground rules for the project
- Project budget
- Project timeline
- The conceptual design of new technology

3.3.2 Background information/Available alternative.

To this point, the researchers have already made available the information that was needed to make this project report possible. We have been at the Electoral commission of Uganda Offices in Kampala, observed process of vote tallying and documented our finding together with our solution for the new proposed system specification of Online voting system.

3.3.3 Project Approach.

We had to the following tasks during our project research undertaken between May 2009 and August 2009.

- | | |
|-------------------|--|
| Phase I: | Secure permissions with officials and commissioners UEC. |
| Phase II: | Researched extensively on online voting systems |
| Phase III: | Install/Test Software |
| Phase IV: | Conduct pilot survey for applicability of the system |
| Phase V: | Conduct systems changes and user requirements. |
| Phase VI: | Write a report. |

3.3.4 Project Goals and objective of the plan.

The business goals and objectives for this project will focus on design for an online voting system that:

- Improves electoral system in Uganda thus ensuring democracy principles are upheld.
- Facilitates coordination and information sharing both internal and external to the participating organizations.
- Enhances the ability and effectiveness of staff to perform their jobs.
- Facilitates coordinated electoral crime prevention and reduction.
- Provides high levels of data security.
- Provides an open, flexible, reliable technology base for the future.
- Facilitates the electronic capture of data at its source.
- Is easy to use.
- Eliminate redundant data entry throughout the organization.

3.3.5 Scope Definitions

This project confined itself to democratic electoral process at national level within the territories of the republic of Uganda. The execution of this project is limited to planning, analysis, design and implementation of “online voting” on a website. A prototype of the system was produced with an implementation plan.

Details of implementation such as user training data migration and changeover, change management, ethical issues, running costs of the voting system and system support were not taken care of in this project since it is a graduation project.

Specific areas of data collection in this search included;

- (a) Staff Electoral commission of Uganda.
- (b) The staff at the head quarters Uganda Electoral Commission.
- (c) The field staff for the Uganda Electoral Commission.
- (d) The people of Uganda or voters.
- (e) Capabilities of Electoral commission of Uganda’s IT technological infrastructures.
- (f) Social and ethical issues that need to be considered within the online voting website.

3.3.6 Items Beyond the Scope.

The project does not include the following:

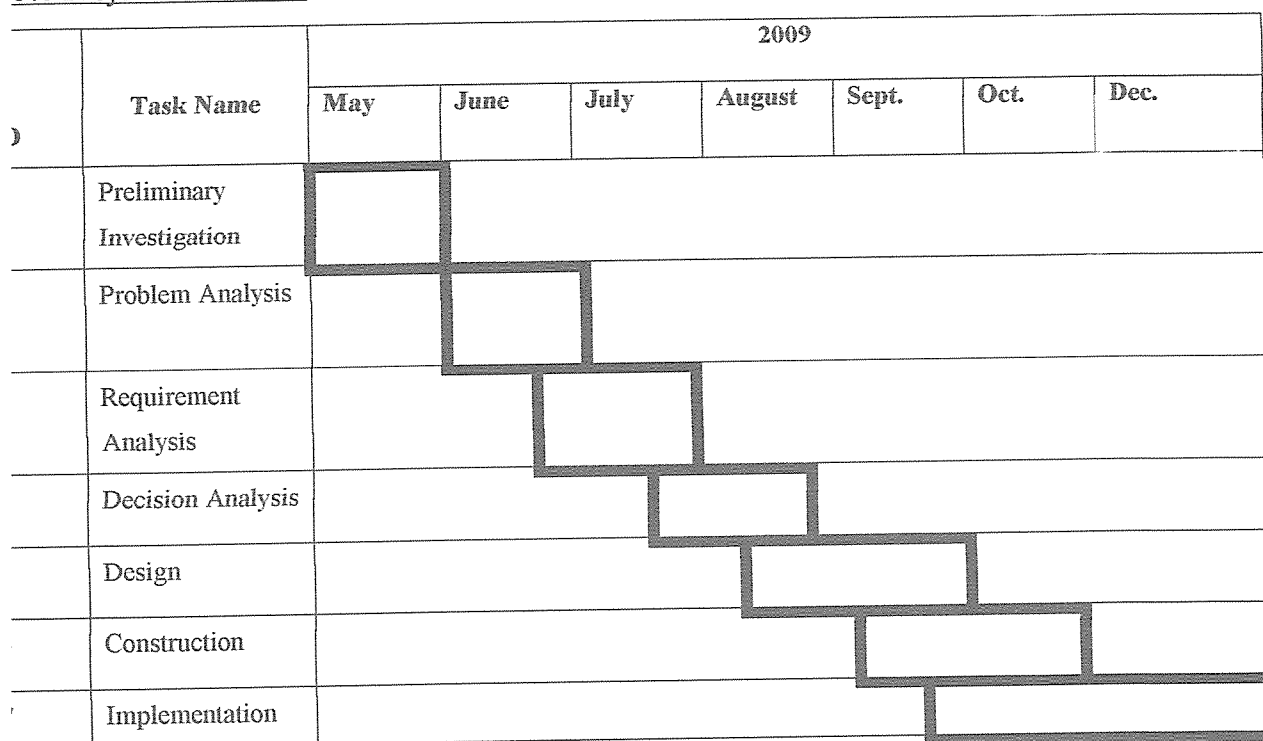
- Implementation of the specified system
- Coding of the system which has been reserved for future research work.
- Interfaces and systems requirements.
- User training and software documentation.

3.3.7 Projected Budget

BUDGET

No	Particulars	number of units	cost/unit (Ughs)	total cost (Ughs)
1	Flash disk	2	50,000	100,000
2	Printing paper	2	10,000	20,000
3	Travel Expenses	2 people	200,000	400,000
4	Photocopying	200 pgs	50	10,000
5	Typing and printing	200 pgs	1,000	200,000
6	Binding	2	2,000	4,000
7	Phone calls	100 people	100,000	200,000
8	Subsistence/Miscellaneous	2 people	100,000	200,000
	Total			<u>1,176,500</u>

3.8 Project Time line- Gantt Chart



3.9 Project Roles and responsibility.

Role	Responsibilities	Participant(s)
Project Researchers.	<ul style="list-style-type: none"> ▪ Ultimate decision-maker and tie-breaker ▪ Provide project oversight and guidance ▪ Review/approve some project elements 	Mr. Sakwa Joel Inzoveri Ms. Manisoor Rhema
Project supervisor	<ul style="list-style-type: none"> ▪ Commits department resources ▪ Approves major decisions undertaken by the project researchers ▪ Review project deliverables. ▪ Issue guidance to the report coherence and approval. 	Mr. Mutaasa Ahmed
Project Manager	<ul style="list-style-type: none"> ▪ Manages project in accordance to the project plan ▪ Supervises consultations from the supervisor ▪ Provide overall project direction ▪ Handle problem resolution ▪ Manages the project budget 	Mr. Joel Sakwa

3.3.9 Milestones.

The following represent key project milestones, with estimated completion dates:

Milestone	Completion Date
Phase I:	
Permissions from UEC.....	15/04/2009
Phase II:	
Research work	21/06/2009
Phase III:	
Install a test software.....	N/A
Phase IV:	
Pilot survey	16/07/2009
Phase V:	
Conduct design changes	20/07/2009
Phase VI:	
Report Writing.....	10/08/2009

3.3.10 Risk Assessment

The initial **Risk Assessment** attempts to identify, characterize, prioritize and document a mitigation approach relative to those risks which can be identified prior to the start of the project.

The **Risk Assessment** was continuously monitored and updated throughout the life of the project, with monthly assessments included in the status report.

Because mitigation approaches must be agreed upon by project leadership (based on the assessed impact of the risk, the project's ability to accept the risk, and the feasibility of mitigating the risk), it is necessary to allocate time into each Steering Committee meeting, dedicated to identifying new risks and discussing mitigation strategies.

The Project Manager conveyed amendments and recommended contingencies to the Steering Committee monthly, or more frequently, as conditions may warrant.

Project Assumptions

The following assumptions were made in preparing the Project Plan:

- UEC employees are willing to change business operations to take advantage of the functionality offered by the new mobile technology.
- Management will ensure that project team members are available as needed to complete project tasks and objectives.

- The Committee participated in the timely execution of the Project Plan (i.e., timely approval cycles and meeting when required).
- Failure to identify changes to draft deliverables within the time specified in the project timeline will result in project delays.
- Project team members will adhere to the Communications Plan.
- The City will ensure the existence of a technological infrastructure that can support the new mobile technology.
- All project participants will abide by the guidelines identified within this plan.
- The Project Plan may change as new information and issues are revealed.

3.11 Project Constraints.

The following represent known project constraints:

- Project funding sources are limited, with no contingency.
- Due to the nature of law enforcement, resource availability is inconsistent.

3.12 Related Projects

None known.

3.13 Critical project Barriers.

Unlike risks, critical project barriers are insurmountable issues that can be destructive to a project's initiative. In this project, the following are possible critical barriers:

- Removal of project funding
- Natural disasters or acts of war

Should any of these events occur, the Project Plan would become invalid.

ata collection and analysis:

3.4.1 Structured Interviews:

The interview was conducted with a number of staff members, electoral commissioners, IT professionals at the Commission, students, legislatures and the general public of Uganda to understand the various departmental works within the scope of this project and to find out more about the working environment of the staff.

3.4.1.1 Merits of interviews:

1. Interviews give the analyst an opportunity to motivate the interview to respond freely and openly to questions.

2. By establishing rapport, the systems analyst is able to give the interviewee a feeling of actively contributing to the systems project.
3. Interviews allow the systems analyst to probe for more feedback from the interviewee.
4. Interviews permit the systems analyst to adopt or reword questions for each individual.
5. Interviews give the analyst an opportunity to observe the interviewee's non verbal communication.

3.4.1.2 Demerits of Interviews:

1. Interviewing is a very time-consuming and therefore costly, fact-finding approach.
2. Success of interviews is highly dependent on the systems analyst's human relation skills.
3. Interviewing may be impractical due to the location of interviewees.

3.4.2 Observation

The researcher will go through some of the records and find out how the elections were conducted, tallied and recorded to find out information such as; details of the electorate, registration numbers and voters' identities, constituency districts, branches, databases and their security implementation, dates, viability, chronological accounts et cetera.

This is owed to the fact that Observation is an ideal mode of data collection since it gives first hand information and not just secondary data.

3.4.2.1 Merits of observation:

5. There is first hand information to be collected.
6. The information collected is less prone to bias.
7. The actual processes are witnessed.
8. Proper measurements can be collected and changes clarified.

3.4.2.2 Demerits of Observation

3. The researcher may be affected by emotions due to human nature.
4. Some complex process can not be understood and thus resulting in poor documentation.

3.4.3 Questionnaires:

The Researchers will be employing this fact finding technique in this research. The questionnaire is to be prepared and to be given to staff members of the electoral commission, **17**

IT professionals at the Commission, students, legislatures and the general public of Uganda to answer them and respond accordingly. The distributing factor will be following the sample size of each of the study population suggested above and this will be 50 people per each sample study population. Some of the questionnaire will be attached at the end of the report.

3.2.3.1 Advantages of questionnaires.

5. Most questionnaires can be answered quickly; people can complete and return questionnaires at their convenience.
6. Questionnaires provide a relatively inexpensive means for gathering data from a large number of individuals.
7. Questionnaires allow individuals to maintain anonymity; therefore individuals are more likely to provide the real facts rather than telling you what they think their boss would want them to.
8. Responses can be tabulated and analyzed quickly.

3.2.3.2 Questionnaires have the following demerits:

6. There's no guarantee that an individual will answer or expand on all the questions.
7. Questionnaires tend to be inflexible. There's no opportunity for the systems analyst to obtain voluntary information from individuals or to reword questions that may have been misinterpreted.
8. It's not possible for the systems analyst to observe and analyze the respondent's body language.
9. There is no immediate opportunity to clarify a vague or incomplete answer to any question.
10. Costly, good questionnaires are difficult to prepare.

Data Collection and Presentation:

The qualitative methods included FDGs and in depth interviews were used. Key informant interviews were conducted for the staff members of UEC and IT specialists.

In the presentation phase, the researchers presented the data inform of research booklet and the system information of the software. Some form of this thesis shall be presented inform of

dataflow diagrams, E-R diagrams, visio-modeller, umbrello, poisedon, a php driven website and a java oriented code.

Organizational Unit studied.

This study focused the Uganda Electoral Commission as an independent organizational unit of study. It encompassed itself on the fact that Uganda Electoral Commission is mandated to conducting the election (“fair elections”) countrywide within Uganda. This trickles down into forming a wider region of Uganda as the organization unit to be studied and the electoral Commission as our Case study number one, USA our case study number two and India our case study number three but in passive.

Study Population.

Uganda has a population of 30 million according to the last census held in year 2000. There are about 13.6 million registered voters. In Uganda, the Army known as Ugandan People Defense Force (UPDF) is also a statutory entity allowed to vote and amounts to about 48,000 troops. The researchers felt that in order to form an effective study population, the research population was divided into survey schemes as:

1. Youth Population
2. Veteran Population
3. Women Population.
4. Male Population
5. Literate population
6. Working population (taxable capacity)
7. Politicians and professionals
8. Religious groups.
9. Civil servants (including ECU)

From these population schemas, the researchers developed an appropriate sample size from which to collect data.

Sample Size:

Sample size was derived from each schema of study population above. For cost effectiveness and time, we limited ourselves to selecting 6 members from each study population to form our sample size. This made it a total of 55 persons studied representing the balance within the whole of Uganda at the end of this research.

The Design Phase.

We have proposed to use SDLC (System Development Life Cycle) as my systems development methodology. SDLC is the traditional methodology used to develop, maintain, and replace information system.

It is a common methodology for systems development in many organizations featuring several phases that mark the progress of the systems analysis and design effort.

Sometimes the life cycle is iterative that is phases are repeated as required until an acceptable system is found. Such an iterative approach is especially characteristics of rapid application development (RAD) methods.

Software is the most obvious and product of the life cycle other essential outputs include documentation about the system and how it was developed as well as training for users each phases in SDLC has specific outcomes and deliverables that feed important information to other phases.

We have derived the following under SDLC:

i. Project Identification and Selection:

This is the first phase of the SDLC in which an organization total information system needs are identified, analyzed, prioritized and arranged. We therefore identified the Online voting system as my project.

ii. Project Initiation and Planning:

This is the second phase of the SDLC, in which a potential information systems project is ex-planned and an argument for continuing or not continuing with the project is presented; a detailed plan is also developed for conducting the remaining phases of the SDLC for the proposed systems.

As per our project, we wish to get a confirmation from our supervisor mandating us to kick off with the project after receiving our proposal and Information system plan.

iii. Analysis:

This was carried out to determine whether the new system to be built would be feasible in terms of technicality and economically with the available resource. We have therefore embarked on substantial analysis and observed the current result handling system which is manual and thus vitalized the need for an automated online result handling system which will handle the backload:

iv. Design

The fourth of the SDLC in which the description of the recommended solution is converted into logical and then physical system specifications.

(a). Logical design

The part of the design phase of the SDLC in which all fundamental features of the system for development in analysis are described independently of any computer platform.

(b). Physical design

This refers part of the design phase of the SDLC in which the logical specifications of the systems from logical design are transformed into tech specific details from which all programming and system construction can be accomplished.

vii. Implementation

This is the fifth phase of the SDLC in which the information system is coded, tested, installed and supported in the organization.

viii. Maintenance

This refers to the final phase of the SDLC in which an Information System is systematically repaired and improved. we wish to repair and maintain my system at this phase having undergone a successful implementation. I will make a strong database system for maintaining the system.

The Implementation Phase;

This was reserved for the future project of implementations of the design specification outlined in this project. The implementation of this design specification will involve:

1. Coding of the systems designs of this project
2. Ordering and awaiting hardware deliverables.
3. Installation of Hardware
4. Employment of staff to operate the systems
5. Systems testing.
6. Live running
7. Start of changeover.

Windows XP should be used and should be used as the operating system since it is familiar with the users. Macromedia Dreamweaver was used to design the website and Mysql was used to design the data base for data storage. Php, java, C ++ was used for programming samples..

Internet Explorer and Netscape was used as the browsers for the users to interact with the system easily without any complications.

11 Conclusion:

This chapter concludes by acknowledging the different stakeholders involved on its completion. It has presented the typical insight of what needed to be done at the end of the project. The following chapter will hence discuss the system design that needed to be carried out during this research work.

CHAPTER FOUR

4.0 SYSTEM DESIGN AND ANALYSIS.

4.1 Introduction

This chapter covers methods used in analyzing, designing and implementation of the system, phases of systems development life cycle, and testing.

Overview

The system must be able to support the organization and carrying out of elections at national, state, and local levels. It must allow voters to register and vote online; it must maintain the normal prohibitions against one person voting more than once in any single election; it must maintain the normal prohibition against non-registered voters voting in any elections; it must also maintain the normal prohibition of any one voter being registered in more than one place.

The system must allow novel forms of election to occur... for example, we will want to have elections as we do now (meaning all voting in a single day) but we also will want to have elections that occur over longer periods of time... weeks, perhaps months. We will want to allow flexible voting policies... for example, we may want an election where once your vote is cast it is irrevocable; we may also want elections where a voter can log on and change his/her vote as many times as desired... as long as it is prior to the end of the election.

We want the system to have an information structure to make it easy for the voters to get at least candidate statements, party platforms, information about voting process, and the law of the land.

The system must support the gathering of statistical information...

4.1.1 Main Entities

- election
- choice (issue, referendum)
- ballot (collection of choices)
- candidate
- election officer?
- voter (citizen)
- electorate (registered voters)
- documents (laws, news, instructions, statements, etc.)
- tally (vote count)

4.1.2 Activities of the system

- documents the law of the land (constitution, etc.)
- documents election laws
- documents candidate/party statements/platforms
- authenticate voters when voting
- register voters

- enforce one-vote-per-voter-per-issue
- tally votes, keep statistics
- report results

1.1.3 Design Issues

- go from cards (concepts and relationships) to classes
 - may have many objects in the system that are not part of the card design... "internal" components of the patterns, etc.
 - may have many methods to implement a single responsibility
- identify the variances... areas that appear right for pattern creation
- develop a user interface...
- program to an interface, not an implementation
- favor object composition over inheritance

Data Analysis and Analysis of the User Requirements:

This phase provided the researchers with knowledge to tackle any user requirements. Software validations, hardware requirements, User requirements, data analysis formed the system development phase. Data was analyzed and the user requirements drawn out from the collected data to know what the user requirements were and what requirements have the highest priority. We had also sought to know exactly what the research provided to improve the current need of a new system from the problem definition of this project.

Methodology for the development of the New System.

The researchers followed the fundamental phases of the system development life cycle (SDLC); planning, analysis, design and implementation. In the planning phase the researcher will identify the scope of the problem and plan the development strategy and goals and the systems benefit to the company. In the analysis phase the researcher will study and analyze the problems, causes and effects of the current system then identify and analyze the requirements that must be fulfilled by any successful solution.

Phases of System Development Life Cycle.

System life cycle is an organizational process of developing and maintaining systems. It helps in establishing a system project plan, because it gives overall list of processes and sub-processes required developing a system.

System development life cycle means combination of various activities. In other words we can say that various activities put together are referred as system development life cycle.

Following are the different activities that the researchers undertook to develop the new system:

- Feasibility study
- System analysis
- System design
- Test Coding
- Pre-Testing

The researchers covered feasibility study, system analysis, system design, coding, testing and implementation. Let us now describe the different phases and the related activities of system development life cycle in detail.

System Study

After study of the existing system, some problems were identified with help of the management, staff, and the clients. It was necessary to interview those people who will be affected by the new system. It was found out that the existing system had no proper mechanism designed to handle pool conflicts and resolution. Therefore, to speed the process of processing of the vote tallying, it was necessary to develop a new system.

Feasibility Study

On the basis of results of the initial study, feasibility study was under taken. The feasibility study is basically the test of the system in the light of its workability, meeting user's requirements, effective use of resources and of course, the cost effectiveness. The main goal of feasibility study was not to solve the problem but to achieve the scope.

7 System Analysis

The Uganda Electoral Commission has been processing most of its records manually, using the physical files and records, which were also manually created. Therefore there was a great deal of clerical effort required to prepare the reports required by management. With the new idea to computerize the entire management system, it means that there would be need for efficient

system to monitor and control how clerks process the transaction of the business and general running of the company.

4.7.1 Problems with Paper Voting

The paper voting systems currently used in Uganda are: full paper ballot schemes. All of these schemes face numerous problems that together have disenfranchised millions of voters.

4.7.1.1 Administration Difficulties

All paper ballot schemes face administrative nightmares in order to get the right ballots to the right locations, including the right proportions of ballots in different languages or with other distinguishing features. Further, the paper ballots required by these schemes are expensive to print, secure and distribute correctly. In the case of Uganda the ballot papers are printed in South Africa; thus the costs of designing, printing and transportation. Further, the mundane, repetitive task of hand-counting is relatively slow, cumbersome, labor-intensive, inefficient and error-prone. Hand-counting the millions of ballots generated in a Uganda presidential election would be quite infeasible, and thus cries to go completely back to full paper ballot systems are unreasonable in practice.

4.7.1.2 User Interface Problems

User Interface problems are again common to all paper ballot schemes. In many cases paper voting system user interfaces allow voters to make mistakes that ruin their ballot. Over voting occurs in many cases because of stray marks or dimpling at multiple indicators or holes corresponding to candidates. Additionally, in some cases like the famed “butterfly ballots,”

4.7.1.3 Accessibility

Paper voting systems are not accessible to many voters with special needs. Fonts are generally small and ballots are generally crowded with names, for example, and these and other issues make voting difficult for vision impaired voters or voters with some learning disabilities. Further all current paper voting systems require some sort of motor control, which makes secret voting impossible for many paralyzed citizens. Because of these and other user interface problems in paper systems, it is said that approximately 2.4 million disabled and 9 million illiterate American voters are unable to vote in

privacy, and millions of other persons with less severe impairments find voting extremely difficult.

4.7.1.4 System Problems

Punched ballots are not guaranteed to be true representatives of the voter's intention or even of what the voter cast, as the ballot is not maintained in its original state.

4.7.1.5 The Electronic Voting Solution

Modern electronic voting systems can solve the problems with paper systems highlighted in the previous section. The ballots are electronic and so this removes the issues and frustrations with paper administration. User interface and accessibility problems can be solved by flexible font size, coloring and other details, as well as multi media interfaces and special equipment to translate the more limited signals of paralyzed voters. Disabled persons report significantly preferring electronic voting user interfaces to the paper user interfaces they used previously.

System failure has been a problem with current electronic voting systems. However, we believe such system failure is a problem with particular systems, particular implementations of those systems, and insufficient testing, rather than a problem with electronic voting in general. Further, we believe that an online – remote voting system can be significantly more reliable than existing systems and comparable single-version systems.

4.7.2 Electronic Voting System Criteria

A reliable, trusted voting system is a vital to communities and countries where matters of importance are decided on by voting. Because of the importance of such systems, as well as the disappointments arising from the use of flawed electronic voting systems, much work has been done in establishing criteria that a sound electronic voting system must necessarily satisfy. The major results of such research was summarized in the following electronic voting system criteria:

☐ *System and Data Integrity and Reliability.*

The behavior and output of the voting system must be correct and must not be altered by tampering with the system or with any data involved in entering and counting votes.

□ *Personnel integrity.*

The persons involved in developing, operating, and administering an electronic voting system must be of unquestioned integrity.

□ *Operator authentication.*

The persons authorized to administer an election must gain access to the voting system only through nontrivial authentication mechanisms.

□ *System accountability and verifiability.*

All internal system operations, including testing and modification, must be monitored without violating voter confidentiality. Additionally, the correctness of the election result must be verifiable.

□ *Voter anonymity and data confidentiality.*

The voting counts must be protected from external reading during the voting process. Also, the association between recorded votes and the identity of the voter must be completely unknown by third parties as well as within the voting system.

□ *System credibility.*

The system's trustworthiness must be irrevocably established and assured.

□ *System availability.*

The system must be protected against both accidental and malicious denials of service, and must be available for use whenever it is expected to be operational.

□ *Interface usability.*

Systems must be amenable to easy use by local election officials, and must not necessitate the on-line control of external personnel (such as vendor-supplied operators). The interface to the system should be inherently fail-safe, fool-proof, and overly cautious in defending against accidental and intentional misuse.

While the above criteria are not provably sufficient, they have generally been agreed upon as necessary. As such a sound, reliable and secure voting system must be expected to meet the above requirements.

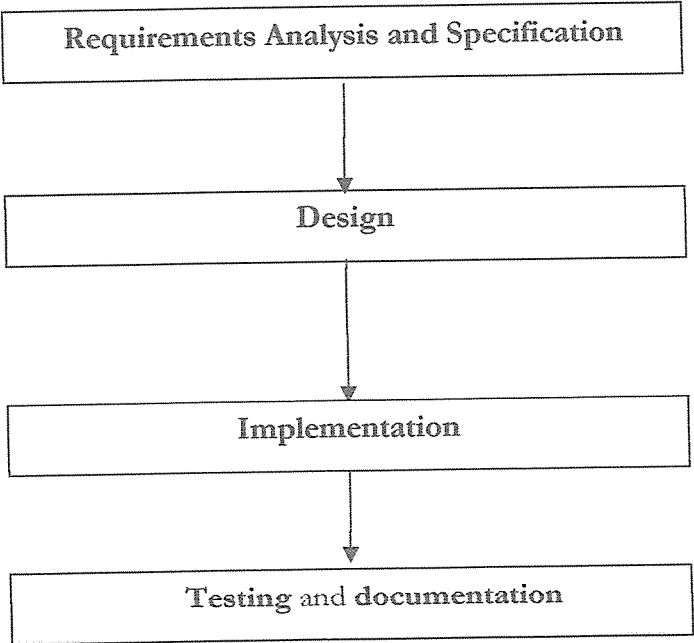
Design techniques and tools used:

8.1 Data Flow Diagrams (DFD's)

Stacey (Information and Technology, 1999) argues that DFD's are used to describe the flow of business operations using only four symbols for these elements: external entities, processes, data stores, and direction which data flows.

Typically, this is divided into four main phases:

- (1) **Requirements Analysis and Specification**, which establishes what the application is to achieve;
 - (2) **Design**, which determines how the application will meet its requirements;
 - (3) **Implementation**, which creates the application as designed (this combines the development of new components with the reuse or modification of existing ones).
 - (4) **Testing and documentation**, which ensures that the application operates as required.
- Intermediate procedures, such as requirements specifications and subsequent designs, are also reviewed thoroughly as a basis for moving from one development phase to another.



8.2 Data Requirements

This included variables that would be translated into important output analyzing the performance of the system. The data required by the new system is determined by the variables used to make analyzes of management decisions within a period of time. The data was extracted from the existing system and other source identified as necessary for the development of the system such as interviewing the employees of the organization.

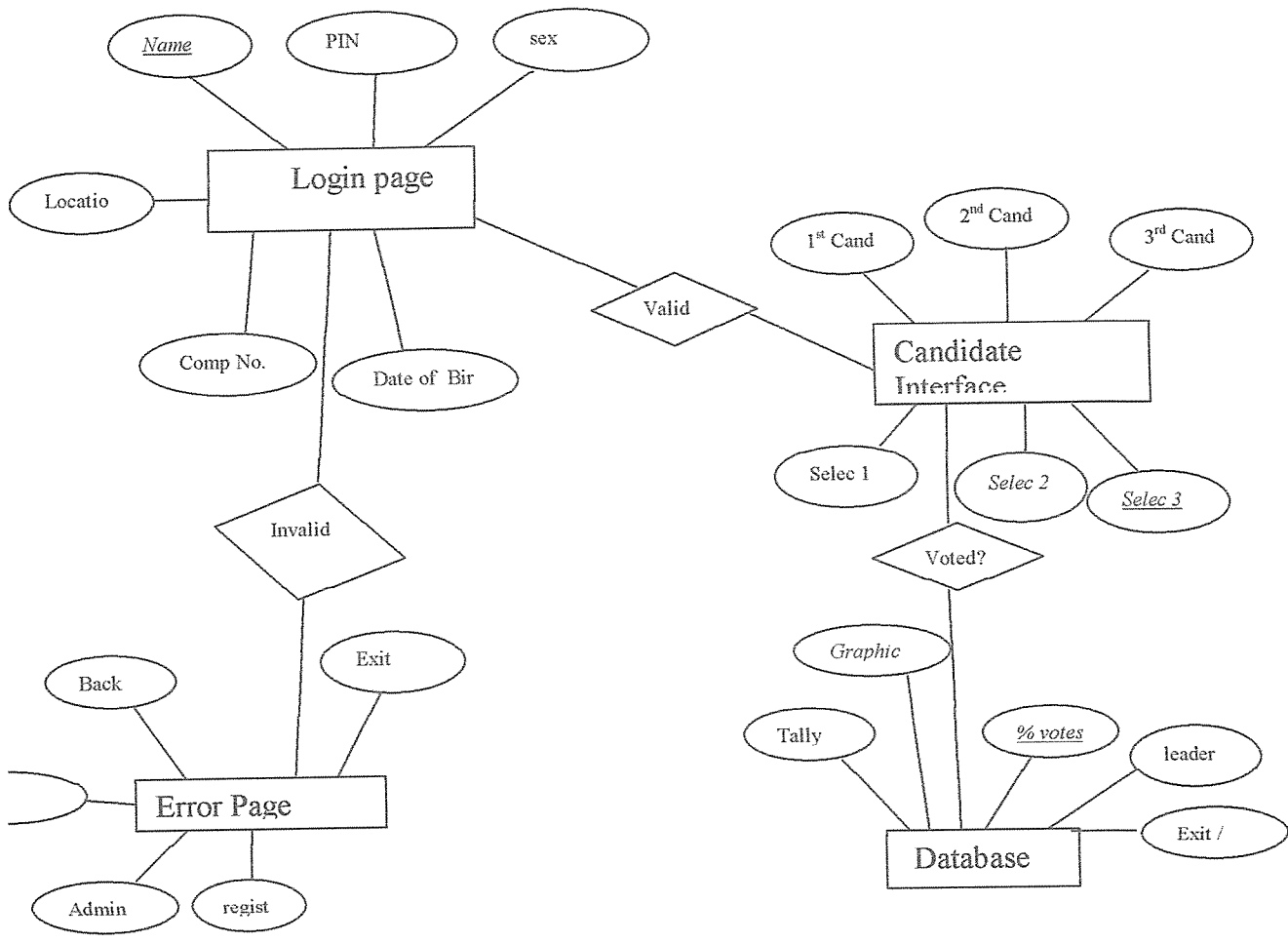
Logical design

This is the relationship between the different entities are shown, clearly showing how the entities are presented and the flow of data in the system. It is shown below by use of entity relationship diagram.

4.9.1 ER Modeling

The ER diagram shows the entities and the attributes in each while indicating how one entity is related to the other. Presence of another entity's primary key as a foreign key in other table gives the two tables an association meaning they are related. Data in a database have some kind of a relationship once analyzed well which is why ER diagrams shown below was used. It is after this where redundancy of the data can be controlled.

Fig 3 ER Diagram of the User Interface of The Online Voting system



0 Physical Design

This is the physical representation of the data in the system, it shows the kind of data used with their data types and this helped the developers estimate the size of the memory the whole database would occupy. Below are the physical design for the system developed by use MYSQL for the organization.

Information

FIELD NAME	DATA TYPE	FIELD_SIZE	CONSTRAINTS	DESCRIPTION
Name	Varchar	20	Required	Name of Voter
PIN	Varchar	20	Required	Personal Identify
Sex	Varchar	20	Required	Sex
Location	Varchar	10	Required	Voter Location
County	Varchar	18	Required	Voter County
Comp Pin	Int	15	Required	Comp Pin Code
DOB	Int	12	Required	Date Of Birth

4.11 Coding

In this stage, the whole system is converted into computer understanding language. Coding the new system into computer programming language is an important stage where the defined procedures are transformed into control specifications by the help of a computer language. This is also called programming phase in which the programmer converts the program specifications into computer instructions, which we refer to as programs. The programs coordinate data movements and the entire process in a system. It is generally felt that the programs must be modular in nature. This helps in fast development, maintenance and future change, if required. This system has been developed using the PHP and MYSQL database management software. Database (MYSQL) allows accessibility of data and retrieval of data easily.

4.11.1 Algorithms log in

```
Algorithm Log In
Start
Prompt user name
Prompt password
Capture user name
Capture user password
    If (user name and password correct)
        Open MDI
    Else Deny access
End
```

4.11.2 Algorithm Candidate- vote

Algorithm Vote

Start

Capture Voter details

Capture vote

Check previous validity

If (Voter => Not Voted)

Voter = voted passed.

Update account

Else deny

end

4.11.3 Algorithm Tally

Algorithm Tally

Start

Capture vote details

Capture current vote

Amount = current + previous votes

Update account

End

Conclusion:

To this point, the system's design and analysis of user requirements are fully understood and the next chapter will majorly deal with design implementation of the proposed solution.

CHAPTER FIVE.

5.0 SYSTEM IMPLEMENTATION AND TESTING

Introduction:

Full System implementations were not done as we were only doing the design. The full implementation should involve, programming, change over, file creation and conversion, user-training, testing and hardware, software acquisition and installation.

System Change –Over

This involves the transfer from the old to the new system. At this stage, all the prior project activities will have been completed and the new system should be ready to take over the electoral process.

However there are factors to be considered by the implementers of this system design:

1. The methods of controlling errors if they happen into occur.
2. Maintenance and operation methods of the new system.
3. The necessary communication required to both stakeholders during the new system change over.
4. The type of personnel responsibility of the system.

Program Testing

This is checking whether the system is doing what is expected. It was done by use of mock/test data collected from the UEC. It also involves putting the system into operations; a test run of the system is done removing all the bugs, if any. . After the designing the whole the system, a test plan should be developed and run on a given set of test data. The output of the test run should match the expected results.

5.3.1 Unit Testing

This is the first stage of testing; this is done by using written test planning and prepared test data. The path consists of a number of test runs such as valid paths through the codes. For each test run, there is a list of condition tested, the test data used and expected results. All the forms that are on the system are tested against the test plan and conditions.

5.3.2 Integration testing

This is the integrating of the components of the entire system so that all can work together to produce required results. Each module is linked to other therefore allowing them to interact. The whole process must be in a specific sequence and within specified response time. The integration between the component and sub-components created in visual basic 6.0 and the database created in MYSQL is fully tested to ensure that they are effectively linked.

5.3.3 System Testing and Implementation

This tests the whole system after linking together all the subsystems. Bugs are identified and categorized in order of priority and are fixed as those with less priority can be addressed in the follow-ups releases in the process of evolution. The following activities are also carried out.

Performance testing validates the response times or transaction periods specified in the functional specifications. It involves timing how long the system takes to respond to a user's request, timing normal operations and also exception cases.

Regression test ensures that the correction during the system test have not introduced new bugs and tests the key functions.

Acceptance testing is a prove by the client, that the system, meets the business requirement agreed upon, in the functional specification. The tested data is replaced with live data provided by the client. The client records all errors and other aspects. They are discussed with the developer, whereby, the errors are corrected by the developer, and the changes are implemented at the expenses of the client.

Data take-on and conversion, the data from the current system is transferred safely to the new system. This is done by:

User enters data; one has to ensure that data entry errors are controlled.

Hardware requirements:

The best proposed computer required is Pentium processor of:

1. Memory 64 MB
2. Processor speed 1.0 GHZ
3. Pentium 3 and above processor
4. Hard disk capacity of 40 GB.
5. Scanner and printer
6. Voting booth.