AN ONLINE VOTING SYSTEM
CASE STUDY: UGANDA MARTYRS UNIVERSITY

By

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A Project Report Submitted to the Faculty of Science for the Study Leading to a Project in Partial Fulfillment of the Requirements for the Award of the Degree of Bachelor of Science in Information Technology of Uganda Martyrs University.

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DEDICATION

I dedicate this project to my supportive parents, Uganda Martyrs University, my supervisor Mr. Mugejjera Emmanuel, my siblings Mrs. Nakato Ruth, Babirye Barbra, Kato Atwiine Milton, Kakuru Atwiine Steven, my sons Kato Husein, Waswa Hasssan, my uncle Mugumya Richard and my wife Mrs. Nakimbugwe Ritah Mary.

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Secondly I thank my fellow students who have always co-operated with me and offered necessary help where need be and for all the help rendered to me, I pray that the almighty awards them abundantly.

I also send my acknowledgment to the faculty of science for having done their job as required for example the results have always been released in time with no errors. May God reward you abundantly.

I also thank the university for all the services that it provides to the students with all equality and the way all students are handled.

ACRONYMS AND ABBREVIATIONS

ICT	Information and Communication Technology
UML	Unified Modeling Language
HTML	Hypertext Markup Language
PHP	Hypertext preprocessor
SQL	Structured Query Language
CSS	Cascading style sheet
MS Visio	Microsoft Visual

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ABSTRACT

The purpose of this study was to develop an online voting system that would ease the process of voting at Uganda Martyrs University. The current system is manual and requires students to move to the polling station in order to cast their vote. In this process, the students have to provide their initials to the voting officials at the polling stations and once provided, the voting officials verify the information provided and the students are given ballot papers in order to complete the process of voting . This process is time consuming and tiresome. The online voting system therefore provides an easier way of voting that does not require ones' physical presence in order to cast their vote.

CHAPTER ONE

1.1 Introduction

The research relates to an online voting system depending on the related problems that have been affecting the current voting system. The proposed system will help on reducing the problem of moving long distance in order to cast a vote, long queues and unfavorable weather conditions that prevent voting by personal presence at the voting stations. An online voting system is an important aspect to be considered by the management of Uganda Martyrs University to improve efficiency through reducing the gap between the haves (those who have knowledge about computers) and the have-nots (people with less or no knowledge about computers), improve on computer voting techniques by simply clicking on the contestants photograph and the vote is casted to the databases, coherent industry organisation, reduce costs for example transport costs among others. A voter is an integral part of online voting industry and Voting is the active part of the medium and once catered for, voting is improves from one location to another.

1.2 Background

Among the on-going national discussion about the internet is its use in the voting process, since voting determines who to take the authority, the stakes are higher than for many other transactions routinely conducted via internet. The public confidence about internet security is increasing but many feel that, online voting requires a degree of security. E-voting and I-voting should not be confused, e-voting deals with the electronic and automated technologies that try to minimize the human elements in the vote collection and tabulation while I-voting is the use of online information gathering and retrieval of technologies to expand the reach and range of the potential voting population.

Globally, the national defense Authorization Act for 2002 and the help America vote Act 2002 included provision to extend a pilot project to internet voting and to conduct it in depth. It was first conducted in Arizona and claims were given out that, adequate security measure exists which makes it possible to conduct public elections on the internet now. Other venders, officials and interested observers vigorously dispute this assertion and point out that, security problems with online voting could undermine future voters' confidence in online election.

Internet voting has been widely reported on press at the federal and state levels are studying its implications. The representatives like Jessy Jackson introduced HR3232 (HR3232) on November 5th 1999 which directed the president to appoint a commission to study internet voting and make recommendation about its use. The president directed the National Science Foundation (NSF) to conduct a one year of study of internet voting which was released in 2011.

In Africa, so many Organisations are still using ballot papers to cast their votes which has been so much affected by time hence leading to long queues. This method arises with some problems such as walking of long distances for people to cast their votes and insecurity for example in counting of the final result among other problems.

In Uganda, online political voting has not been tested in the any political field but in steady generally online voting have been tested in other fields such as Bet Awards through sending text, WhatsApp and E-mail messages among others. Still in Uganda, there is a digital divide that is to say, the difference between the haves and have notes as explained before. Studies show that those who are young and more affluent have better computer knowledge (haves) than those who are less affluent and educated (have notes) (Bousor, 2004 and Smith, 2003 Smith and Manna, 2005) Basing on him, he suggests that, Electronic means should be used hopefully to provide voting from home based computers, personal computers, and internet

kiosks which will help close this digital divide to reduce on the problems they face in the current system such as high costs incurred in moving long distances, and queues among others once implemented.

1.3 Problem Statement

Internet technologies and the new inventions that come up every now and then introduced a new trend on how different sectors perform, the voting sector was one of the areas that these inventions were integrated where by proponents now cast their votes online in different countries using home based computers and internet kiosks (Smith D et al 2005). However, due to poor network, lack of enough computers and low literate rate of people about computers in Uganda Martyrs University, the voting process which needs to be integrated to online due to the challenges faced in the physical voting like long queues, harsh climate, mistreating opponents by opposition time wasting during votes counting among other factors and insecurity problems, the computer based online voting system was looked at as the way that would support online voting in the developing institutions (Uganda Martyrs University).

1.4 General Objective

The general objective of this research is to help Ugandan Martyrs University students use their personal computers and Desk top computers to vote for their leaders in order to reduce the problems associated with the current voting system.

1.5 Specific Objectives

To analyze the current voting system and review the literature related to the current system.

To design and develop the system that will efficiently reduce the problems associated with the current voting system.

To test and validate the system that will help Uganda Martyrs University students vote online

1.6 Scope of the Study

In this era of the digital world, internet voting will enable students with personal, desktop computers and liquid crystals to cast their votes both by simply clicking the contestants photograph. This system will help students of Uganda Martyrs University to cast their votes from anywhere at any time using their personal computers. This will be done through carrying the cartridge and place in the E-voting devices where it will display the contestants on the screens so that there is hardly any confusion over the identification of the candidates and voters will just make choice by clicking on their preferred candidates photograph and then the vote is casted and submitted to the administrators.

Since it is carried out in an institution of the halves, this will take a period of one year and it is to be tested first by voting the union president of the Uganda Martyrs University where by the administrators will use the system first and with its success, it will be implemented so as the students can also have access to it.

1.7 Justification for the system

It is the purpose of the new system to address all the problems plaguing the current system. This system was used in analyzing and storing of information either automatically or interactively. This was done in the following way: a report was generated conforming to particular information needed by the management via the computers. This would require the input of necessary data and record of voting system and a report was generated. The proposed system would also have some other features such as:

1. Accuracy in handling of data
2. Ease and quick voting by students
3. Flexibility that is to say it could be accessed at any time
4. Better storage and faster retrieval system

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

An on line-voting application system is a computer based system that helps people cast votes from any were at any place on their computers. This system can further be computerized from computer based to mobile based system. In this chapter, literature is viewed on different issues concerning online and in particular online voting. It also narrates how voting is conducted how to realize effective online voting using votes, findings, conducting online, the challenges of online voting that affect voting use and the upcoming technologies that aim at solving these problems. The online voting system would help students and staff of Uganda Martyrs University to cast votes even beyond voting station from anywhere. By this system, lecturers and students would reduce on time wasted in queues and long distances of traveling so as to cast their votes. Different researchers have written about the above system in different ways as indicated below.

2.2 Online Voting Application Systems

Many reports have been generated about online voting systems and still more are generating. Different authors have also come up with different arguments and claims on how on line voting is conducted in their home countries for example,

According to Katiyar, S., et al. (2011) reports that, using cryptography and Steganography at the same time, says we try to provide Biometric as password security to voter accounts. The scheme uses images as cover objects for steganography and as keys to Cryptography. The key image is a Biometric measure such as finger prints. Proper use of Cryptography greatly reduces the risks in these systems as Thacker's have to find both secret keys and the templates. The basic idea is to merge the secret key with the cover image on the basis of the

key image. The result of this process produces a steno image which looks quite similar to the cover image but not detectable by human eye. The system targets the authentication requirement of a voting system. 3.31-voting would reduce the cost for stuffing polling stations and also funds needed to pay for voting machines.

In addition to that, Estonian Election law 4 each voter shall have one vote. When a voter has given several votes electronically, the last vote shall be taken into account. If a voter has voted both electronically and by a ballot paper, the ballot paper shall be taken into account. Within the system of electronic voting taking only one vote per voter into account is guaranteed by a system similar to the so called system of two envelopes, used upon voting outside the polling station of one's residence during advance poll days. Upon voting by electronic means a voter makes her or his choice, which shall be encoded (placed in a so-called virtual inner envelope). Thereafter the voter shall approve the choice by his or her digital signature, which means that personal data is added to the encoded vote (so-called outer envelope). The personal data and the encoded vote shall be stored together until the counting of votes on the Election Day, with the aim of ascertaining that the person has given only one vote.

The personal data of a voter and the vote given by the voter shall be separated after the fact that the voter has given only one vote has been checked and repeated votes have to be eliminated. It is possible to open the so-called inner envelope only after the personal data added to the encoded vote have been separated with the help of a key given only to the members of the National Electoral Committee, after the polling stations have been closed. Thus, the system of electronic voting guarantees that only one vote per voter shall be taken into account, ensuring, at the same time, that the voting decision remains secret.

In addition, electronic voting systems are more versatile and flexible than anything previously known. Today, the logistics surrounding elections involves economic, time and

human costs that make it difficult for them to be conducted frequently. Some electronic voting models –not all– simplify this process and make it possible to imagine a future in which more participation tools could be made available to citizens. It should also be mentioned, not forgetting the important factors regarding security, that a good electronic voting system would be much more exact and precise than the current one. As Andrea R IERA , the person in charge of Scytl pointed out during the presentation of the citizen consultation Madrid Participation, there are still so many more errors on paper than in electronic format.

However, these new participation channels are actually good? Should we back an electoral system that includes the remote vote from home? Would it be a democratic advantage or a disadvantage Andrea R IERA. These questions are closely related to the theoretical analysis of democratic representation, which is now experiencing difficult moments. Increasing direct citizen participation could be one solution because it is an attempt to reduce the role of the political parties by empowering citizens with new participation.

Following the argument of Andreas A UER and Alexander T RECHSEL , the citizen will not vote considering the general interest, he/she will only consider his/her own interest] (AT01: 45-46; see Su01). I think however that this strong defence of the current electoral routine is a direct consequence of the system's weaknesses and it should strengthen the need for a democracy with more participation channels. If a short one-day meeting has become an essential component in our democratic behaviour, it is clear that we have a serious problem because the political system is not actually progressing. The relationship between citizens and their representatives cannot be reduced to an occasional point of contact and political socialization should not rely upon this small parameter. It should be a day-to-day process. Within this normal democratic framework, the absence of one act of socialization as a

consequence of the introduction of Internet voting should be of no importance and it should be easily accepted. It should also be noted that there could be virtual socialization areas.

The Barcelona Technical Engineering Association (CETIB) is a good example of the first one. Before June 2005 the members of this Association could renew the presidential every four years by voting through only one channel. There was an official polling station in the Association's main building, in downtown Barcelona, but this electoral organization was disadvantageous for those members who did not live there. For instance, if we analyse the previous results, it is easy to prove that the percentage of Barcelona inhabitants who voted was higher than the percentage of citizens of this city on the census. Neither did total turnout rates ever reach 10% of the electoral roll. Therefore, in June 2005, the Association's Board decided to accept two voting channels. They intended to increase the total number of voters and also to balance the privileges of some members with a new distribution of votes from a geographical point of view. Each electoral county was to have the same proportion of voters and registered members. Unfortunately, the turnout decreased in June 2005, but there was significant progress in geographical balancing. As Oriol C ISTERÓ ' S graphs indicate, the Barcelona's County, including the capital Barcelona, decreased from 71 to 64 per cent of the votes cast.

Many authors think that Internet voting may endanger the public nature of the voting day because the changes in the electoral routine, an essential component for any democratic procedure, allow votes to be cast from private places (companies, home, etc.). The political socialization process, then, will be different and it could also generate different and maybe negative political values because there will not be a physical relationship among voters. Following the explanation of Andreas A UER and Alexander T RECHSEL ,the citizen will not vote considering the general interest, he/she will only consider his/her own interest] (AT01: 45-46; see Su01). I think however that this strong defence of the current electoral

routine is a direct of the system's weaknesses and it should strengthen the need for a democracy with more participation channels. If a short one-day meeting has become an essential component in our democratic behaviour, it is clear that we have a serious problem because the political system is not actually progressing. The relationship between citizens and their representatives cannot be reduced to an occasional point of contact and political socialization should not rely upon this small parameter. It should be a day-to-day process. Within this normal democratic framework, the absence of one act of socialization as a consequence of the introduction of Internet voting should be of no importance and it should be easily accepted. It should be noted that due to all challenges faced in the current system, the system which would reduce all the challenges faced that is to say, a computer based system was suggested.

Literature Review still has it that, 53intuitive basis on how to judge voter intention when in doubt. Hanging Chad's were made infamous in the highly contentious 2000 United States presidential election, where many Florida votes were cast using the Votomatic punch card ballots. Incompletely-punched holes resulted in partially-punched chad, where one or more corners were still attached, unfortunately the system does not always guarantee a clean cut (punch) and there is no hanging chad, dimpled chad or pregnant chad - where all corners were still attached, but an indentation appears to have been made. These votes were not counted by the tabulating machines (6,358 out of 433,043). Optical Mark-Sense Voting: A voting system where voters mark paper ballots by hand or using a ballot marking device, then the ballots are stored in a locked ballot box and run through a scanning device to count them (Voter Action, 2008). This technology was developed in the 1950's to automate the entrance examinations at the ACT College, soon after Westinghouse Learning Systems began exploring its application to elections. To the voter, these implementations seem similar to the Australian ballot, as the ballot appears the same, except for index marks in the margins used

by the ballot scanner to locate voting targets. First generation optical scanners used infra-red light to scan voter intentions on the ballot and were unable to reliably count marks made with anything but carbon black inks or graphite. Next generation systems use invisible light and generously accept single lines, check marks, "X" in or near voting targets to show voter intentions. The major problem with this technology is its accuracy. Unfortunately, mark sense ballot tabulators, judge ballots using mechanical criteria that differ significantly from the intuitive criteria people use. Identical ballots can be read differently by different machines, because they use different sensing technology. All optical mark-sense ballot tabulators are computer based, which brings about issues of software security and trustworthiness.

Direct Recording Electronic Voting: These systems were originally introduced in 1986 and emulated the look of the traditional lever voting machines, whilst replacing the levers and mechanical parts with buttons and microelectronics. Direct-recording electronic (DRE) voting machines, record votes by means of displaying a ballot provided with mechanical or electro- optical components, which can be activated by the voter (typically buttons or a touch-screen); that processes data by means of a computer program; and records voting data and ballot images in memory components (Voter Action, 2008) . The first design essentially mimics the interface of a lever machine. In a sense that, the entire displayed ballot is visible at once on the screen. As opposed to the lever machine, in which a voter moves levers to make choices, with this kind of design the voter navigates from one screen to the next by pushing a button

2.3 Findings.

With over five methods used in the USA to cast votes, the system is open to problems such as lack of uniformity, the miscalculation of votes, ballot staffing, machine failure and blatant fraud. There is also a major push in USA to overhaul the existing voting system. At the top of the list for accomplishing this, is the implementation of electronic voting (e-Voting) along

with internet voting (I-voting). With the advent of these technologies, can the emergence of new voting methods prevent future voting mishaps? Will e- voting technology allow I-voting to become the standardized method of voting of voting for most major election in in USA from local, county and state elections to well publicized presidential election. A discussion of these questions highlights some of the numerous opportunities, barriers, and security concerns of internet enabled voting.

I-voting could also reduce the number of errors made by both the voters and the electro administrators and allow for easier adoption of uniform standards in the ballot format, since it could be transmitted via the internet from a central election agency to all local and regional polling places. Bridging the digital divide and internet security issues may be the most important barriers that must be overcome if I-voting becomes aviable option in the USA.

2.4 Challenges And Limitations

The presidential election of 2000 will be remembered as one of the biggest voting fiascos in the history of the USA (CIO-2000) Television network announced early on election night that presidential hopeful AL Gore had won in the state of Florida, only to retract the statement later because it was too close to calculate. Then Florida officially claimed Bush had won which caused a major uproar across the country. In fact, in southern Florida, thousands of ballot papers were tossed out because many voters could not decipher the "butterfly ballot". Even with the latest election for Bush's second term, the results were challenged by some of constituting election fraud. The USA current voting system was not working as well as it could.

2.5 How The Current System Will Work

In this era of the digital world, internet voting will be conducted as follows, students with their own laptops will vote their leaders from any place as long as they are registered in the

university's databases and to those with no laptops will use the university's desktop computers to cast their votes. This will either be by simply torching the contestant's photo or simply clicking on the contestant's photo. The will help students of Uganda Martyrs University to vote for their leaders in a short time and easier since more are equipped with computer knowledge. This will be done by simply carrying the carrying the cartridge and placing it in the computers, enter the id number and password then it displays the contestants on the desktop so that there is hardly any confusion over the identification of the candidates and voters will just make choice by clicking on the photo then the vote is cast.

CHAPTER THREE

METHODOLOGY AND SYSTEM ANALYSIS

3.1 Research Methodology

Research methodology had many methods and the scope of research methodology was wider than research methods. Methodology is a systematic theoretical analysis of the methods applied to a field of study. Therefore, from the definition, a methodology covers the methods used within the study.

3.2 Research Design

This describes the nature and pattern the researcher followed while collecting data only of the study area. Here, the researcher used the case study design which consisted of detailed information that was got from the targeted population (students and staff). This helped to provide a clear understanding of how an online voting system operates.

3.3 Study Area

This study was conducted from Uganda Martyrs University where the researcher found out that the idea of having an online system is supported by the University administration, students and the university's staff. This enabled the researcher to find out the problems encountered during the process of manual voting system.

3.4 Study Population

This refers to the collection of elements, people among others that can be used to investigate a particular fact or situation. The study population involved University administrators, students and the university Staff that were interviewed and given questionnaires to fill and thereafter, collected and evaluated.

3.5 Sample Size And Sampling Techniques

The population size that was used in the study was composed of university administrators, customers and restaurant staff that were interviewed individually to assess the problems faced by using the manual way of voting and found out how relevant the proposed online voting system was to the university.

Sampling techniques refer to methods that the researcher used to identify the respondents who took part in the study. Here, the researcher used random sampling techniques so as to give equal chance and opportunity to the specified respondents who included University administrators, students and the staff during the study.

Rapid Application Development methodology is a software development methodology that uses minimal planning in favor of rapid prototyping. Its aim is to produce high quality systems quickly at a low investment cost through iterative prototyping, active user involvement and computerized development tools such as Graphical User Interface builders, Database Management System, computer aided software engineering tools, 4^{th} generation programming languages, code generators and object oriented techniques.

System design method is a widely used computer application development method where its use is often specified as a requirement for government computing projects.

3.6 Advantages of the RAD Model:

Reduced development time.

Increases reusability of components

Quick initial reviews occur

Encourages customer feedback

Integration from very beginning solves a lot of integration issues.

3.7 Disadvantages of RAD Model:

Depends on strong team and individual performances for identifying business requirements.

Only system that can be modularized can be built using RAD

Requires highly skilled developers/designers.

High dependency on modeling skills

Inapplicable to cheaper projects as cost of modeling and automated code generation is very high.

3.8 Diagram of RAD-Model:

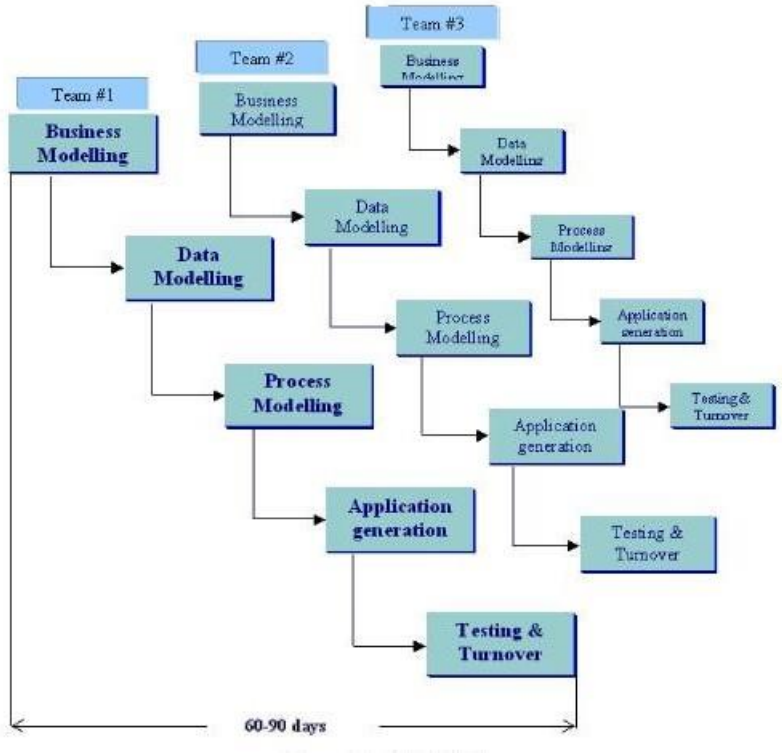

Figure: 3 Rad-Model

Source: Primary data

The phases in the rapid application development (RAD) model are:

Business modeling: The information flow is identified between various business functions. **Data modeling:** Information gathered from business modeling is used to define data objects that are needed for business.

Process modeling: Data objects defined in data modeling are converted to achieve the business information flow to achieve some specific business objective. Description are identified and created for CRUD of the data objects.

Application generation: Automated tools are used to convert process models into code and the actual system.

Testing and turnover: Test new components and all the interfaces.

3.9. System Development Life Cycle

3.9.1planning

A project plan was developed as well as other planning documents. It was aimed at providing the basis for acquiring the resources needed to achieve a solution. This phase ensures that the problem solved is the one that needs to be solved and that the initial description is complete and consistent.

Under the planning phase of the project, a project time-line, work plan and Budget was developed. Under this phase;

The project leader was appointed

The system flowcharts were prepared

The characteristics of the proposed system were defined and identified

3.9.2 Analysis

At this point, the system in place was analyzed to determine where the problem was in an attempt to fix the system. This step involves breaking down the system in different pieces to analyze the situation, analyzing project goals, breaking down what needs to be created and attempting to engage users so that definite requirements can be defined.

Under analysis, Requirement gathering is the most crucial aspect as many times communication gaps arise in this phase and this leads to validation errors and bugs in the software program. Therefore, the following techniques were used to gather information

3.10 Data Collection Methods

Various methods of data collection do exist but the researchers choose the two main sources of data collection in carrying out their research. Namely;

1. Primary sources
2. Secondary sources

Primary sources refer to the sources of data collection in which the researcher makes use of empirical approach such as personal interviews, observation, case studies, and questionnaires among others

Secondary sources refer to the sources of data collection in which researchers make use of already gathered resources such as previous research, web information, historical data, diaries, letters, and government reports among others.

Personal Interview

This is a systematic way of data collection where the researcher asks questions related to the research topic and interviewees respond through a face to face interaction. The oral interview was done between the researcher and the administrators of Uganda Martyrs University where

reliable facts were acquired basing on the questions posed to the administrators by the researcher which apparently helped the researcher in starting the work and also helped the area to solve the challenges that would be catered for in the presentation of the new design. In this method, the participants were both male and female students and administrators of Uganda Martyrs University of all related racial. I tried asking questions about how the current system has been working and basing on the functionality of the existing system which was associated with a lot of problems like inaccuracy in vote counting, effect of time associated with long queues, long distances to report on voting stations, a new system that is to say, online voting system was opted for.

Associated problems

Basing on the fact that the system is for the institution, there were a lot of challenges during data collection for example, students could not give in ample time to be viewed well for they had less time due to continuous lectures. For the case of administrators, some were new to the institution and did not understand how the existing system worked. Due to all challenges faced when using interviews, the alternative was opting for questionnaires.

Questionnaires

With questionnaires, a lot of tools were used in data collection for example pens, pencils, books, reams of papers among others. With these tools, a lot of questionnaires were generated and sent to both students and some administrator. These were associated with questions like how the existing system was working and its associated problems. Depending on the answered questionnaires, a lot of problems were associated with the existing system which opted for the researcher to go in for the new system. With this method, some questions were answered depending on how everyone interpreted but all in all, the researcher managed to

compile the results of all questionnaires and came up with the a conclusion of coming up with the new system that is on line which helped to solve some problems with the existing system.

Since the system is to work in the haves, I opted for questionnaires since they can all read and write at their own pace and time. This method still is good because for someone to answer it, he or she is not forced but rather from his own love meaning accurate and firsthand information is acquired.

Sampling method

This is a method of data collection concerned with a selection of a subset of individuals from a population to estimate the characteristics of the whole population. In this case probability sampling will be used as a method of data collection. Probability sampling refers to a sample in which every unit of a population has a chance of being selected in the sample, and the probability can be accurately determined. Samples will be got from students and administration of Uganda Martyrs University so as to come up with a better system.

Study of Manuals

Manuals and reports based on voting system were obtained and studied so as to obtain lots of information concerning the system to be developed. This is a data collection method that involves the process of examining and evaluating already existent literature material to obtain facts and data regarding a specific subject. Locating these sources and retrieving the information can help in data collection.

In the development of the records management system, this research methodology was mainly used in the analysis and design phases of the system development process. This is because it permits the researcher(s) to analyze changes in trends.

Design

In systems design the design functions and operations were described in detail, including screen layouts, business rules, process diagrams and other documentation. The output of this stage describes the new system as a collection of modules or subsystems. The design stage takes as its initial input the requirements identified in the approved requirements document. For each requirement, a set of one or more design elements were produced as a result of interviews, workshops or prototype efforts.

Design elements describe the desired system features in detail, and generally include functional hierarchy diagrams, screen layout diagrams, tables of business rules, business process diagrams, pseudo code, and a complete entity-relationship diagram with a full data dictionary.

Database Design

A relational database design was used to design the database. A relational database management system (RDBMS) is an excellent tool for organizing large amount of data and defining the relationship between the data sets in a consistent and understandable way.

A RDBMS provides a structure which is flexible enough to accommodate almost any kind of data. Relationships between the tables are defined by creating special columns (keys), which contain the same set of values in each table. The tables can be joined in different combinations to extract the needed data.

A RDBMS also offers flexibility that enables redesign and regeneration of reports from the database without need to re-enter the data. Data dictionaries were used to provide definitions of the data used; these included the final data structures for the various tables and their corresponding data fields, description and sizes the user application programs and interface

were developed using PHP, CSS, HTML, and Java Script with support of structured query language (SQL) and MYSQL.

SQL is a language used to create, manipulate, examine and manage relational databases. SQL was standardized in 1992 so that a program could communicate with most database systems without having to change the SQL commands. Unfortunately one must connect to the database before sending SQL commands and each database vendor has a different interface as well as different extensions of SQL. Though SQL is well suited for manipulating database, it is unsuitable as a general application language and programmers use it primarily as a means of communicating with databases, another language is needed to feed SQL statements to a database and process results for visual display or report generation. The advantage of PHP and HTML is that you can run their programs on any enabled platform without even recompiling the program.

Implementation phase

Here all the iterations were brought together and integrated to make one working system. Modular and subsystem programming code was accomplished during this stage. Unit testing and module testing was also done in this stage.

Systems Testing and Validation

Testing was done after the system had been put in place. This was done in two ways: Implementation and Unit testing were carried out on individual modules of the system to ensure that they are fully functional units. I did this by examining each unit, checked to ensure that it functions as required and that it adds client's data and other details and also ensure that this data is sent to the database. The success of each individual unit gave me the go ahead to carryout integration testing. All identified errors were then be dealt with.

I also carried out integration and system testing after different modules had been put together to make a complete system. Integration was aimed at ensuring that modules are compatible and they can be integrated to form a complete working system. For example, I tested to ensure that when a user is logged in, he/she is linked to the appropriate page, and can at the same time access the database. As one of the final specific objectives of this study, validation of the system is very important. Validation of the system was done by comparing it to the questions that were asked by the users at Uganda Martyrs University.

Assumptions Made by the Researcher

The following basic assumptions were made while designing the system.

With regards to the operation of the system, it was assumed;

That the system shall be used by the students to vote for their leaders.

That every system user shall have a unique username and password which shall be assigned by the administrator.

That the system shall be used to add, update and delete students records

That the normal user shall not have the right to delete information from the system

That the operating system environment shall have a client-server architecture

With regards to the intended users of the system, the following suppositions will be made;

That the end user shall have a basic knowledge of working with computers

That the end user shall have a basic knowledge of the English language which is used in the GUI and associated documentation.

Analysis of Existing System

An in-depth study of the end-user information was conducted for developing a functional requirement of the proposed system throughout the system analysis phase. At the beginning of this phase, data about the existing voting system was collected through several techniques such as internet and document review. The study on the current system was to be performed based on the collected and as a result the user requirements of the proposed system were to be determined thus requirement specification was to be produced as deliverable at the end of this phase.

Analysis of the new system

In this phase, students and the administration of Uganda Martyrs University were interviewed about the current monitoring system and the information gathered was analyzed to come up with a new voting system that would be convenient for both the students and the administration at the University. Furthermore, samples were taken from the administration and students so as to highlight the researcher on how the current voting system was to work.

Existing System and its associated problems

The current system happens to be a manual system where all operations are done by casting votes on ballot papers by the students at Uganda Martyrs University. Due to the manual system, the main challenge associated with it is that they waste a lot of time in queues while casting their votes, others move long distances to reach the polling stations which in turn lead fatigue of some people.

Objectives of the proposed system

The proposed system was developed to help students of Uganda Martyrs University cast their votes online. The system covered the following functions in order to support the students and administration to solve the associated problems so as to achieve the objectives. Namely;

1. To design and develop a system that would allow students cast their votes easily.
2. To design and develop a flexible application system that would be able to operate under any conditions.

Design tools. The researcher used the following tools in regards to developing of a web site.

1. Windows 8 Operating system
2. Adobe dream weaver, by this the web site code will be written using dream weaver because it shows were the errors are.
3. PHP will help the website code since it ensures the uniformity and consistency throughout.
4. MySQL it is a database management system that helped to incorporate and interact with the website at large.
5. The word processing applications like Microsoft- Word 2010 helped the researcher documentation of requirements and technical document findings of the project.

Conclusion

The development of online voting system involved many phases. The approach used was a top-down one concentrating on *what* first, then *how* and moving to successive levels of details.

The first phase started with a detailed study of the problems and prospects of voting using computers. In the course of this study, many problems were discovered to have hindered the effectiveness of the existing manual system. These problems, information needs and activities were documented and later used as the basis for system design, which immediately followed the first phase. The design phase was concerned primarily with the specification of the system elements in manner that best met the University needs.

CHAPTER FOUR

SYSTEM ANALYSIS AND DESIGN

4.1 Introduction

This presents an overview of the existing system, design and coding tools and procedures are discussed.

4.2 Voting in the Current System

Uganda Martyrs University as at the time of this research was still relying on paper based procedures for all the steps of institutional voting.

Every voter must move to the polling center with their voter identity card as proof that they are voters and students at the time; they are then given ballot papers which they use to vote for their favorite aspirant.

After the voting activity, votes are counted by hand one by one till a winner is identified. The diagram below shows the summarized process that the manual voting goes through.

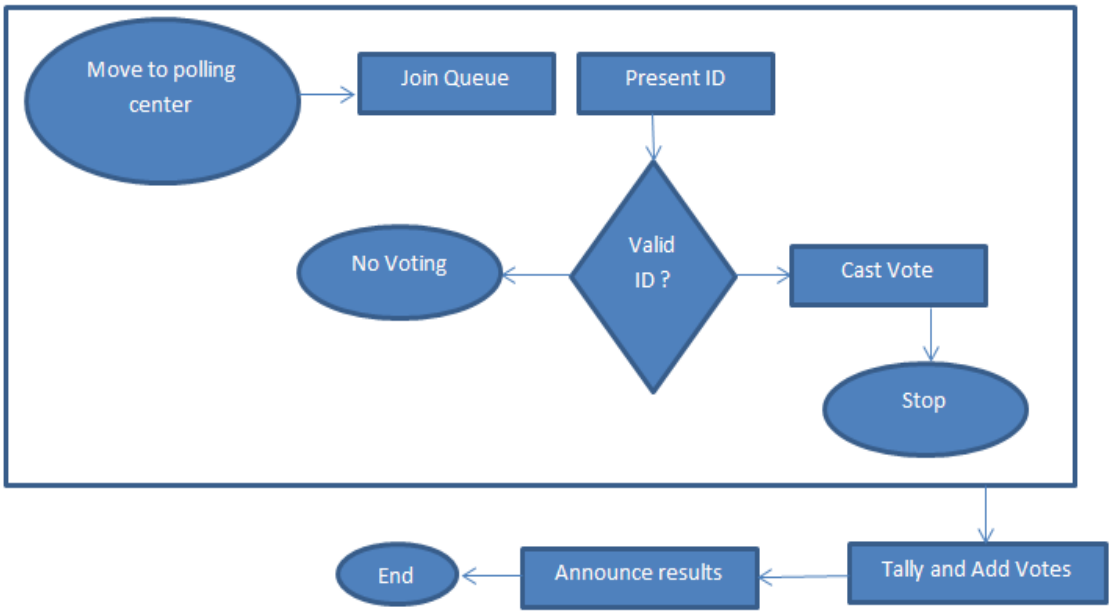

Figure 4.1 The Voting Process As In The Current System

4.3 Analysis of the Current System

The system performance features include the following, less data entry. Since the system uses existing student registers, it reduces multiple data entry

Cheap to finance: Due to the fact that results are written down on paper the cost of simply providing these is relatively low compared to electronic alternatives.

The current system is available. The current system requires no network access or availability and as such is more available since it is not affected by poor network signals/ deviations in signal.

4.3.1 Weaknesses

The current system is subject to human bias that can tamper with the true electoral results.

The system lacks convenience since it requires physical presence at the polling center in order for one to cast a vote.

It presents a higher likelihood of low voter participation.

The current system lacks automation when it comes to vote counting, which makes it tiresome to use.

4.3.2 User Requirements of the Proposed System

The system should satisfy the following user requirements;

Easy to use graphical user interface that was enable users Interact with the system.

A secure and well configured database as back end.

4.3.3 Functional Requirements

The electoral committee was have to add voter card numbers and names of voters into the voters' sub-system.

The system should enable voter to vote.

The system should process and display election results.

The system was auto invalidate agent tokens after they have submitted results.

The agents must only use their EC tokens to submission.

The EC be able to monitor all submissions as they happen.

4.3.4 Non Functional Requirements

Reliability: The system should be able to produce acceptable results at expected time rates**.**

Multi-threading: The system should be able to allow several users to access it at the same time.

Usability: The system should be as easy to use to the officials, staff and voters.

Availability: The voters should be able to access the system whenever they need during system up time.

Maintainability: The system should be easy to maintain regarding security beef ups and tune ups.

4.4 Description of Proposed System

The proposed web based voting system was to enable registered voters to vote from anywhere as long as they can access the internet.

The electoral committee will have to add voters to the commission database in order for the system to be able to allow them to vote. The users will have to be assigned unique passwords that they can change prior to elections. This is to allow them to access the system to cast their vote but only and only once.

The system has the ability to automatically tally votes per aspirant as the voters continuously vote. And will display the result to each and every voter who logs in.

4.5 System Specification Requirements

- **Hardware**

The following hardware are required on a computer for the proposed system to work;

Sufficient hard disk space of about 100GB and more

RAM of 1GB or higher

Pentium 4 processor

UPS (Uninterrupted power supply)

Internet connection

- **Software**

Windows operating system (windows 7) but most preferably Linux operating system.

Xamp Server

Web browsers for example Google chrome, Microsoft edge among others.

4.6 Benefits and Costs of the Proposed System

With the proposed system, results misrepresentation will be cut down since votes are automatically tallied by the system.

Increased voter turn up will be achieved since there will be no need for voters to travel distances in order to participate

Data processing will become more accurate since human errors will be minimized in final result calculations.

4.6.1 System Costs

For the system to be successfully implemented, the EC and the university will have to incur these costs.

Training the voters on how to efficiently use the system.

Register synchronization costs was also to be incurred. Some data was to be transferred from main student's database to the voting sub system.

4.6.2 System Users

The voters, network technicians and supervisory teaching staff was to be the main users of this system.

4.6.3 Use Case Diagram

The use case diagram below indicates the activities within the system and the actors responsible for performing those activities.

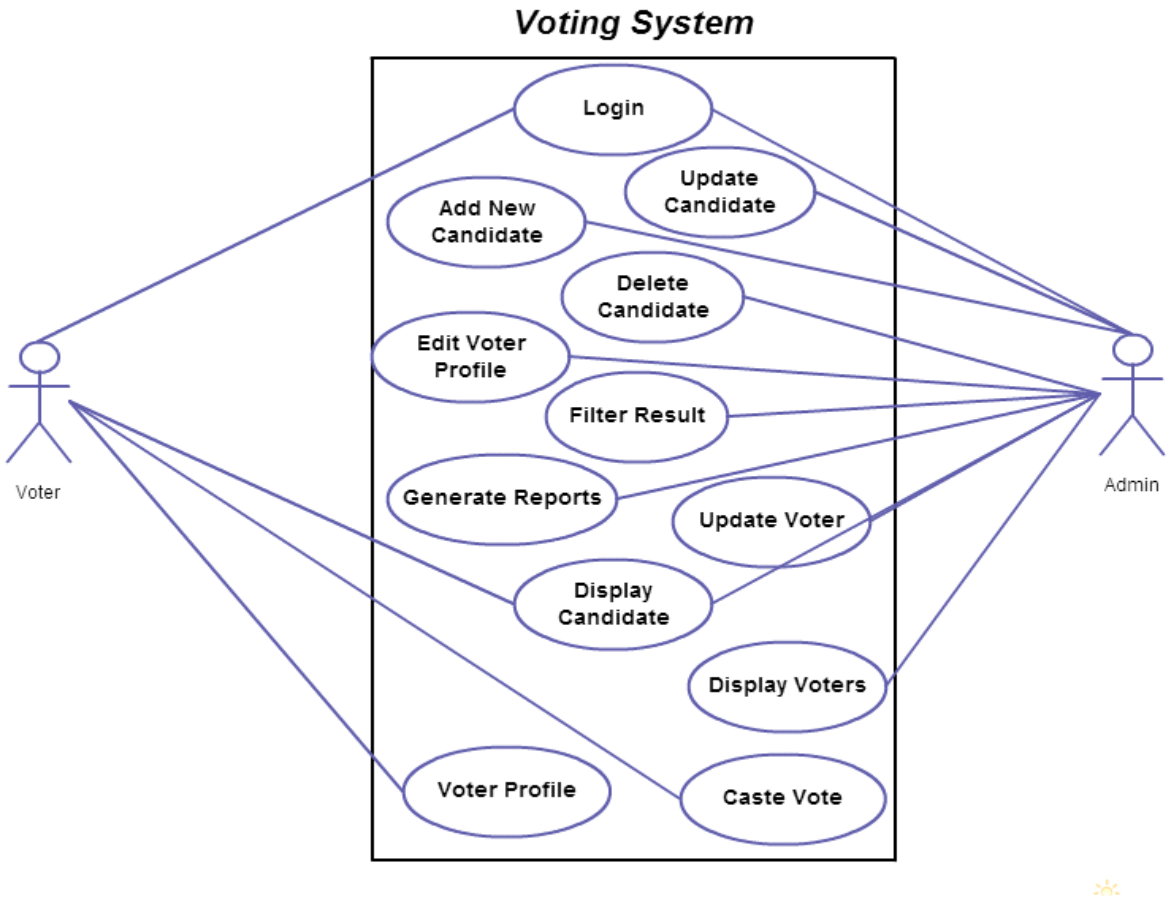

Figure 4.2: A Use Case Diagram for the Proposed System

4.6.4 User Interface Design

The system was designed as web based with a number of web pages but all sharing a common outlook but with different functionality. The planned layout designed was as in the following diagrams.

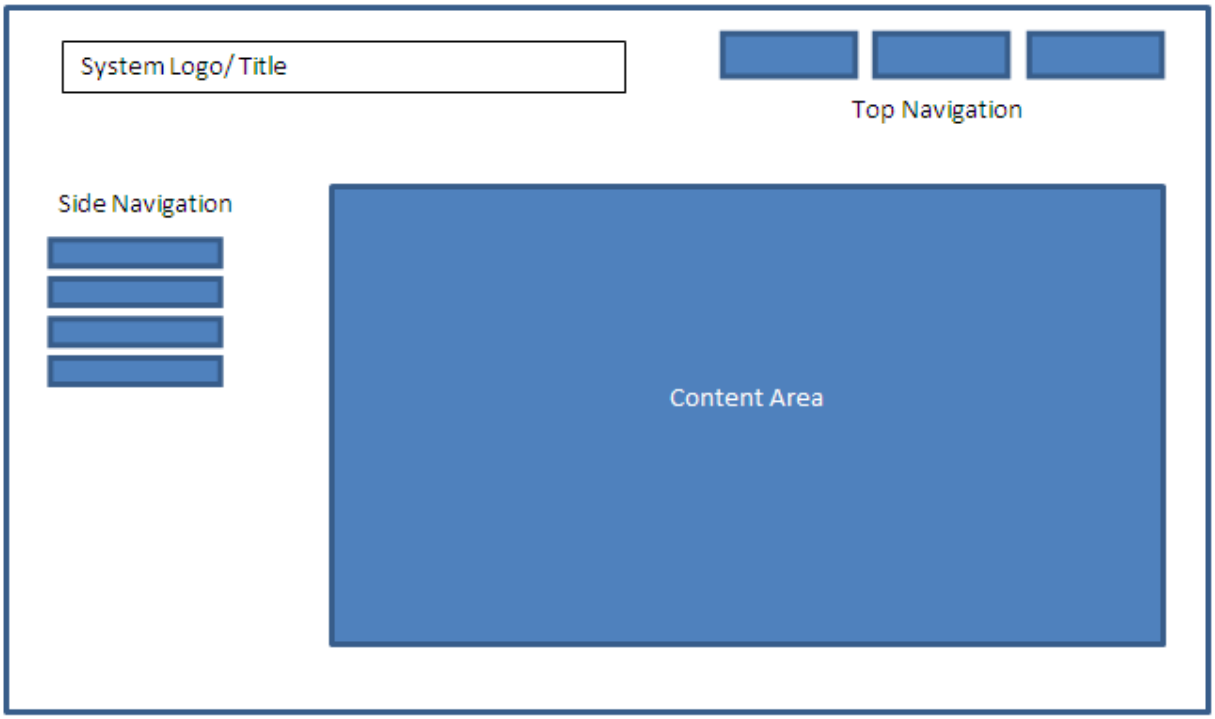

Figure 4.3 The General System Layout Structure

The above page depicts the general layout of each page that is part of the designed system.

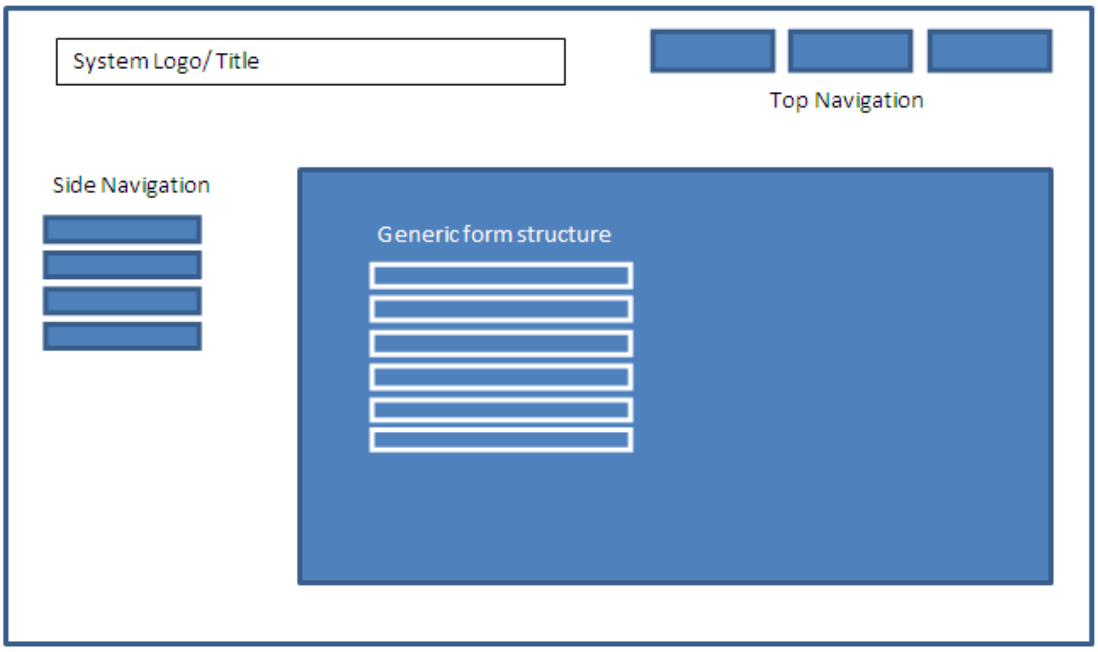

Figure 4.4: The General Planned Form Layout Design

The above diagram shows an impression of the design for each data entry form that was to be used in the system.

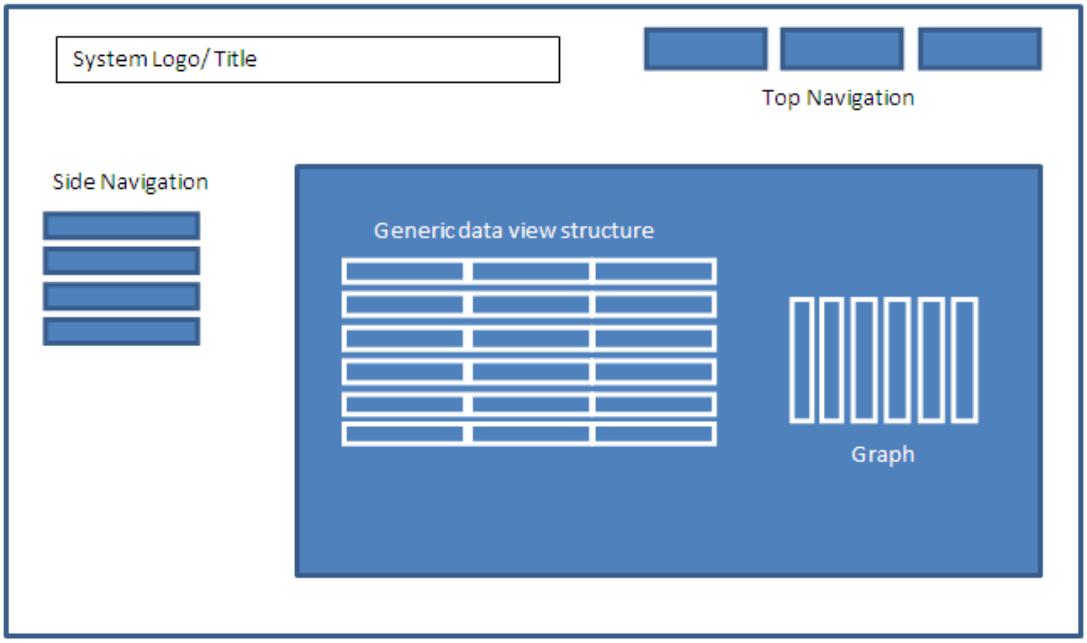

Figure 4.5: The Planned Layout Design For All Pages That Display Data In Tables.

The above diagram depicts how all data view pages like student lists will look on the pages.

4.6.5 Process Diagram

This diagram shows the abstract composition of the system. It includes the external factors that affect the system and how they impact the system. The external factors are in terms of

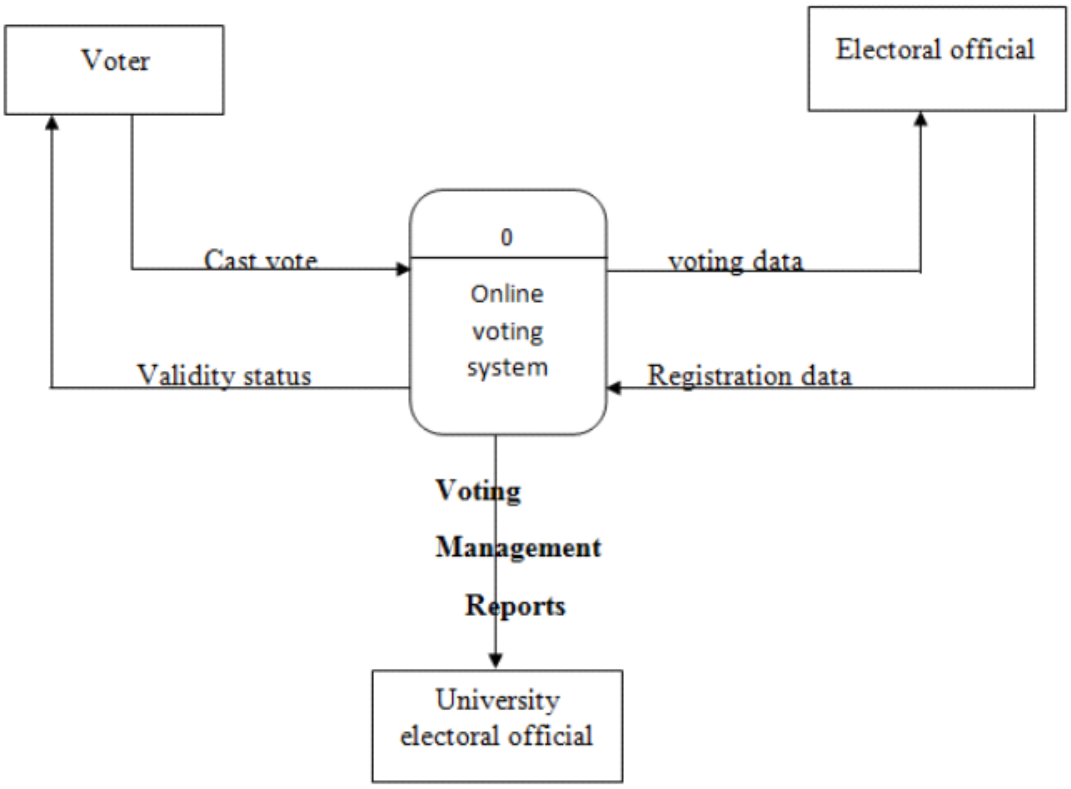

Figure 4.6: A Process Diagram For The Web Based Voting System.

4.6.7 Context Diagram

The diagram below is the context diagram for the proposed system, this details how the system was operating and related to the events that arise during usage.

4.6.8 Data Flow

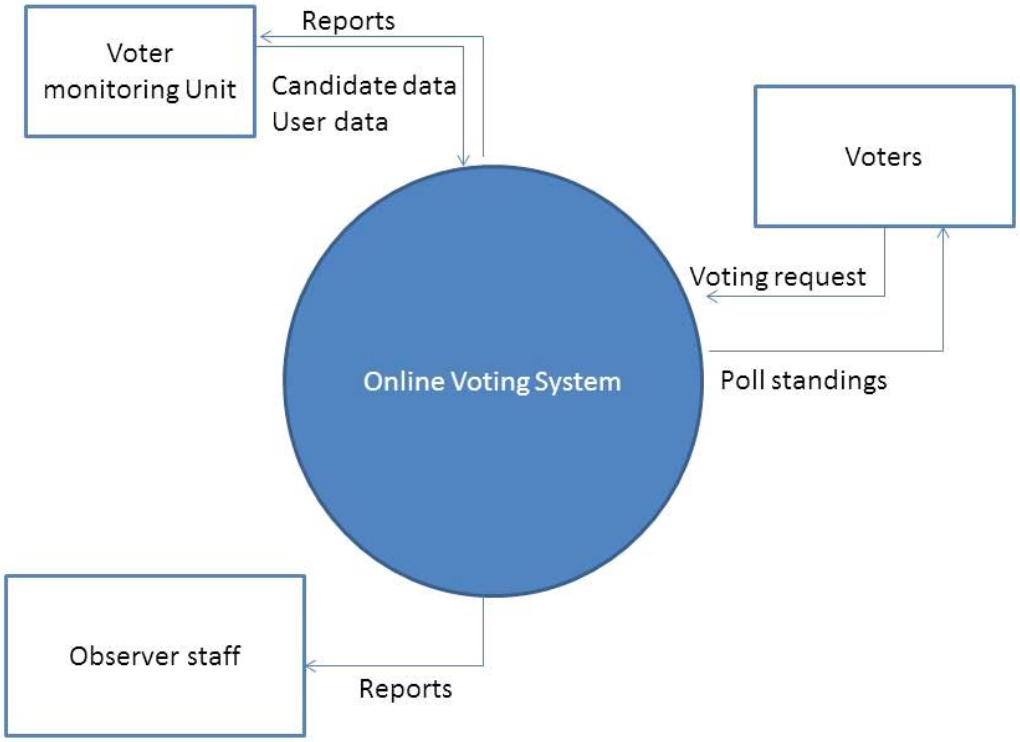

Figure 4.7: A Context Diagram For The Web Based Voting System.

4.6.9 Activity Diagram

The diagram below shows the processes and stages that data undergoes including processing stages. The voters do online voting and the data is stored in the database. Officials and administrators can view and manage users.

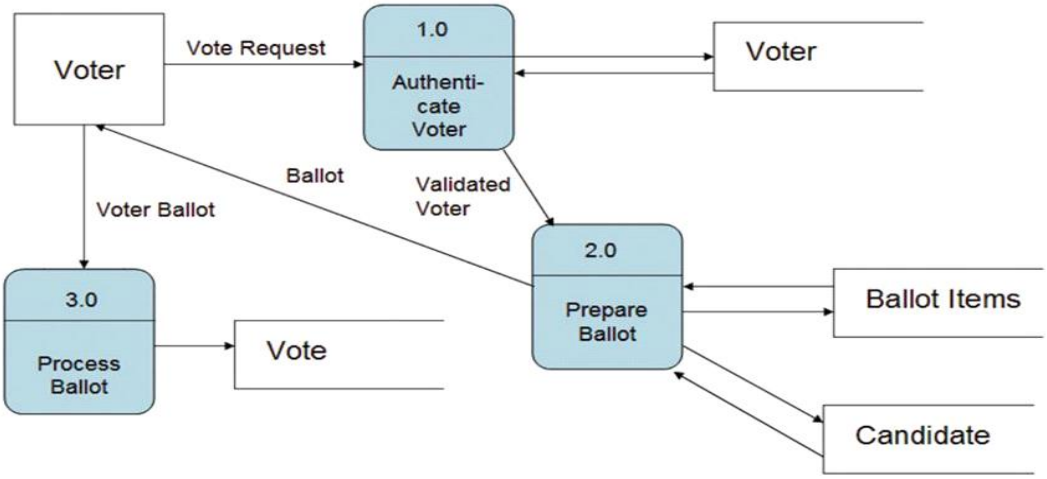

Figure 4.8: A Data Flow Diagram For The Proposed Web Based Voting System.

The activity diagram shows the different steps involved in the process of online voting. It shows the iterative steps taken by the system to accomplish the tasks at hand. The diagram illustrates the voting system processes.

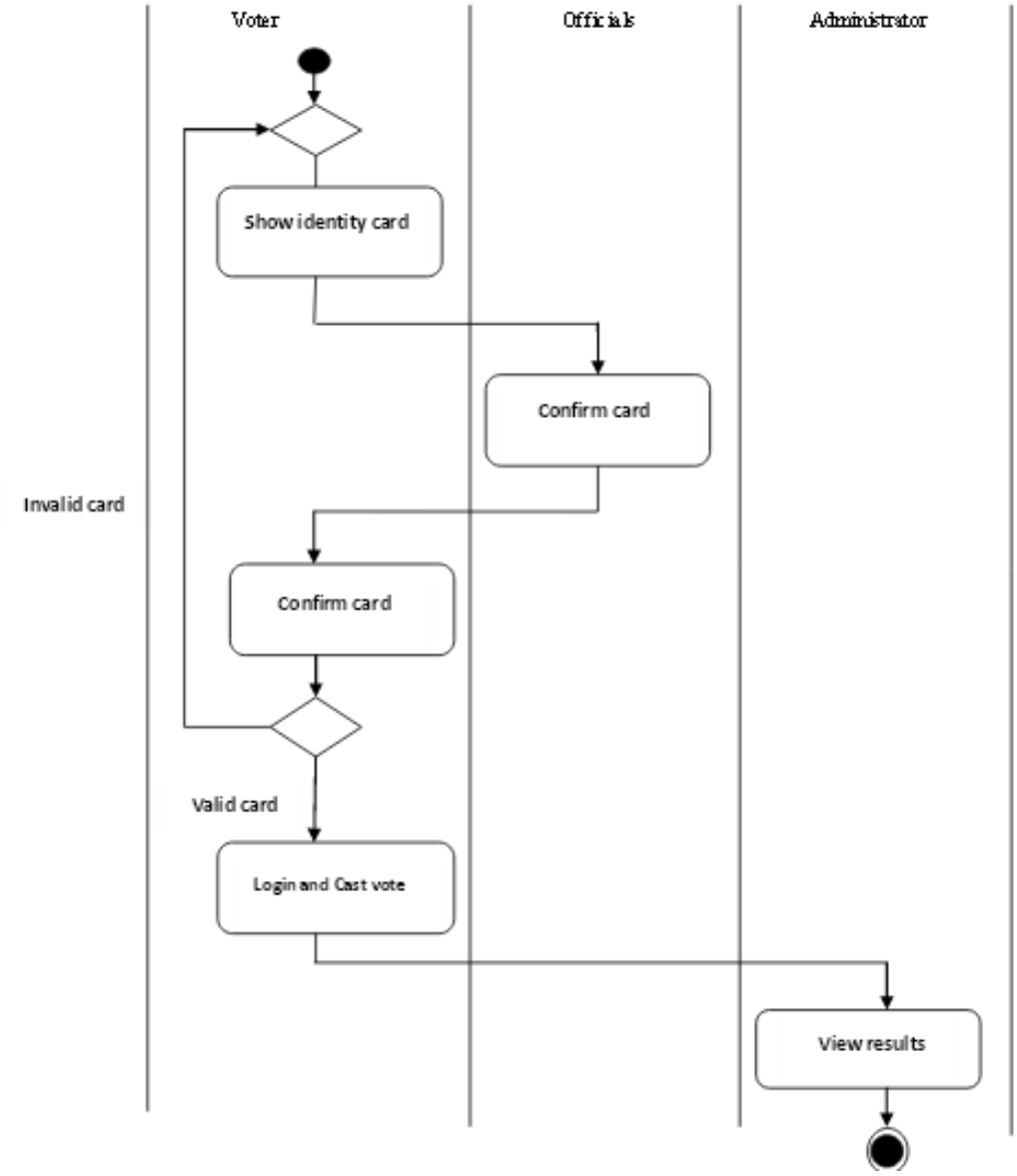

Figure 4.9: A System Activity Diagram For The Voting System

4.7 Conceptual Data Models

Modeling of the Data is done during the first stages of the database development process. The data model focuses mainly on what information should be stored in the database. The information needed to build the data model is gathered during the requirement analysis. A good data model should consider the current and future needs of an organization in order to support the business process within an organization.

In order to accommodate the above requirements a data model must be designed that captures the essential entities and relationship that are present in a Human Resource Management application. An Entity Relationship Diagram (ERD) gives a graphical representation of the tables (entities) in the database and the relation between them.

The rectangles represent tables while a "diamond" represents the relation between them and a diamond within a rectangle represents an associate entity.

The cardinality is the frequency of a relationship between two entities. The types of cardinality are:

One to one (1:1), every record in entity A matches exactly one record in entity B and every record in B matches exactly one record in A,

One to many (1: M), every record in A matches zero or more records in B and every record in B matches exactly one record in A, and

Many to many (M: M), every record in A matches zero or more records in B and every record in B matches zero or more records in A.

If there is a many to many relationship between two entities, then the relationship between them is represented as Associative Entities. The diagram below show the conceptual foundation of the database of the OVS.

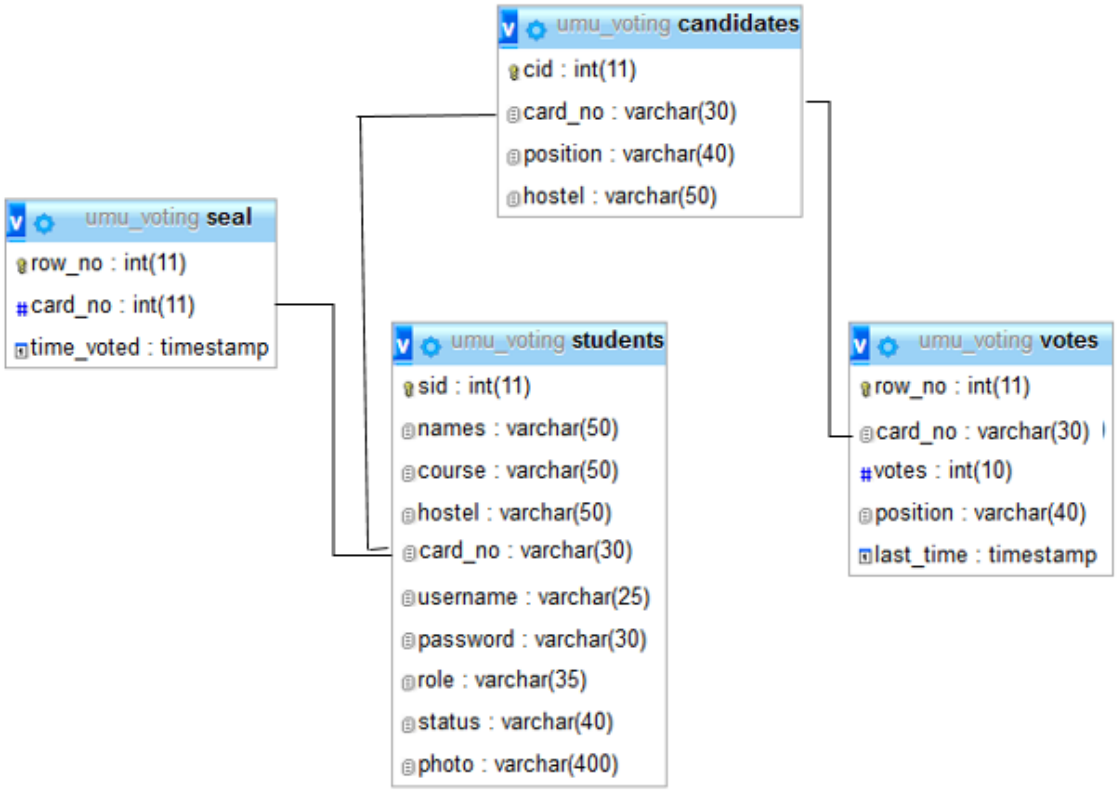

Figure 4.10: An ERD Diagram For The Voting System

4.8 Conclusion

This chapter analyzed the current system, looking at its strength and weaknesses and also described in detail the proposed system together with its benefits.

CHAPTER FIVE

IMPLEMENTATION AND TESTING

5.0 Introduction

This chapter gives an overview of the implementation strategy and explains how users can navigate through the newly developed OVS.

5.1 User Interface Implementation

The system was developed as an interactive mechanism between the user at the interface and the database using the web-browser. This tool enables a user through a web browser to interact with the MYSQL database to enter, edit, view and retrieve such data as per the privileges granted. These activities were achieved using Java servlets. HTML forms offer the best layout to enter data, change and view the database. These forms were also kept as short and simple as possible for easy public awareness on the use of the tool, some of the forms and report interfaces created include the following:

5.1.2 The Login/Home Form

This is where a new user/voter starts; the individual is required to provide a username and password. When this is provided the system validates the user if the entered information tallies with what is in the database. He/she is then logged in otherwise the voter/user isn't logged in.

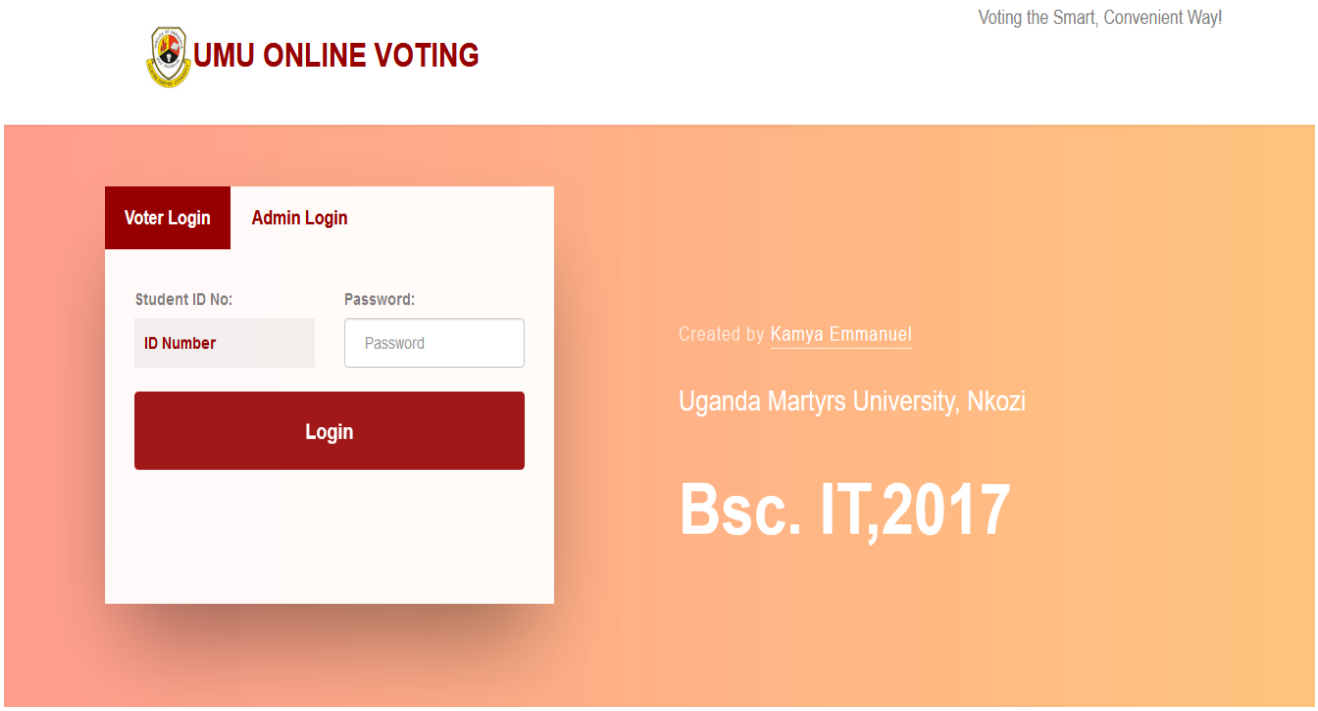

Figure 5.1: The Home and Login Page

5.1.3 The Voter Registration Form

This form is strictly preserved for the system administrator. He/she is the only one with the privileges to access and use this form. The link leading to this page is disabled for ordinary users.

5.1.3 The Add Position Form

This form allows the admin to register new positions that was be voted among for example president, councilor etc. This is determined by the number of valid aspirant slots.

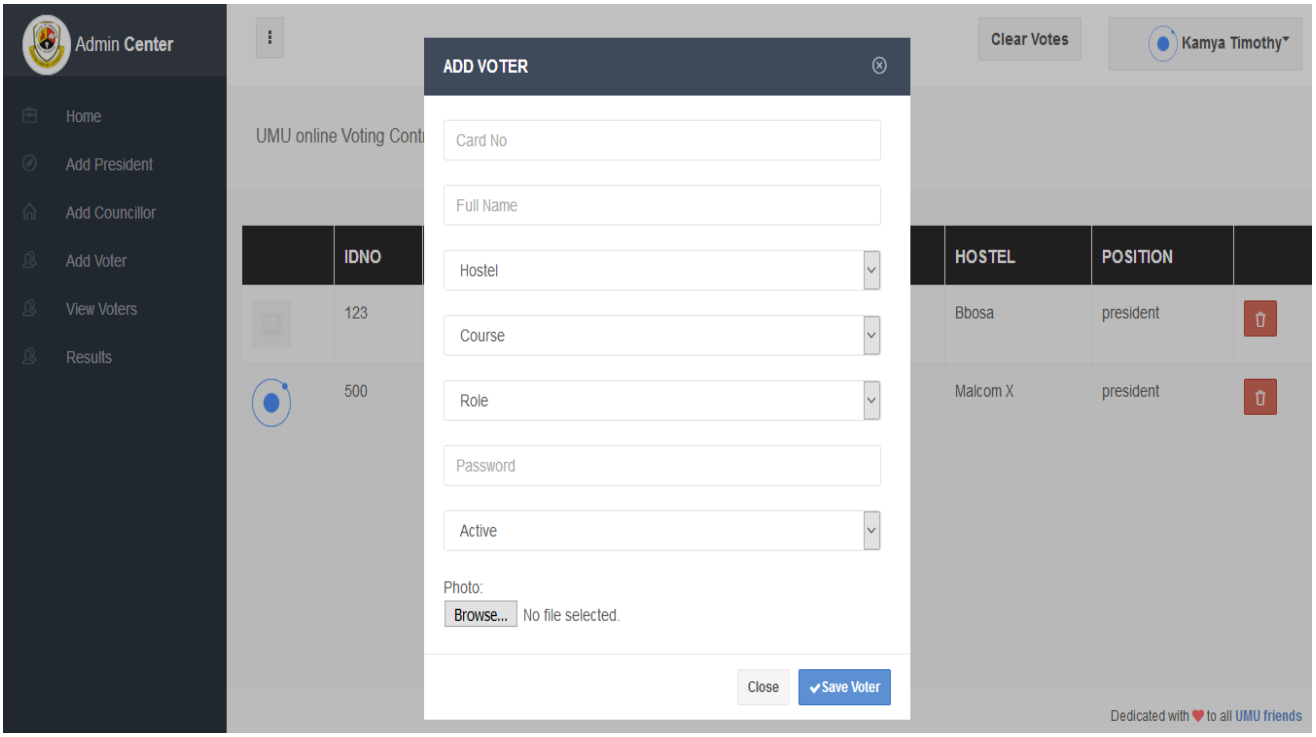

Figure 5.2: The Voter Registration Page

5.1.3 The Voter List

This page displays a list of voters registered with the OVS. These are the only ones legible to cast votes on the polling day.

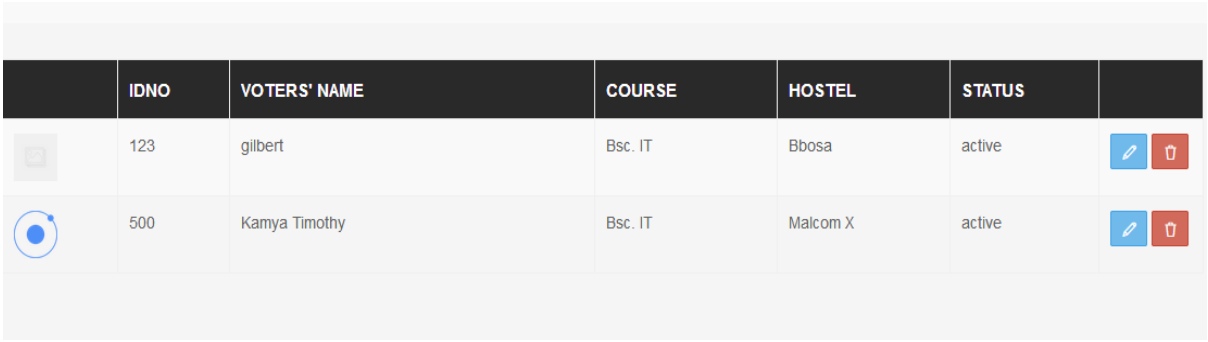

Figure 5.3: The Voter's List Page

5.1.3 The Votes Count Page

This page displays a summary of the current votes cast standing; it shows the scores of each candidate from the time of poll commencement to the time of retrieval. This very page is used as determinant of the final vote results. This also graphically plots the standings.

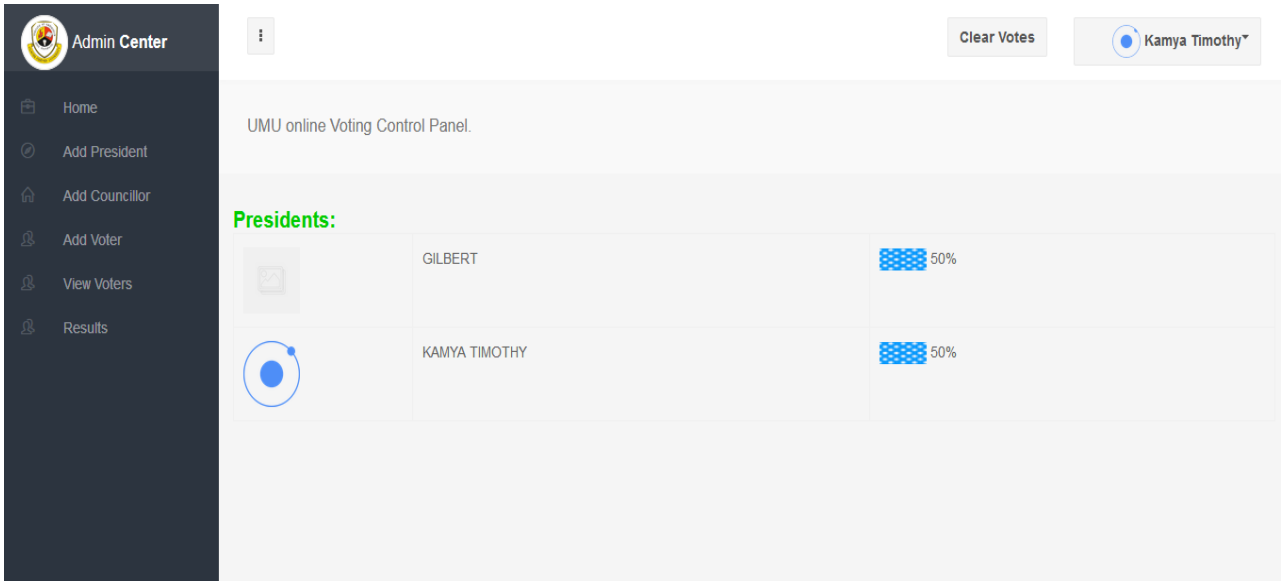

Figure 5.4: The Reports/Vote Count Page

5.1.3 The Voting Form

This page allows an authentic voter to cast a vote for their favorite candidate among the available aspirants. It also displays the current scores for each aspirant for a specific post.

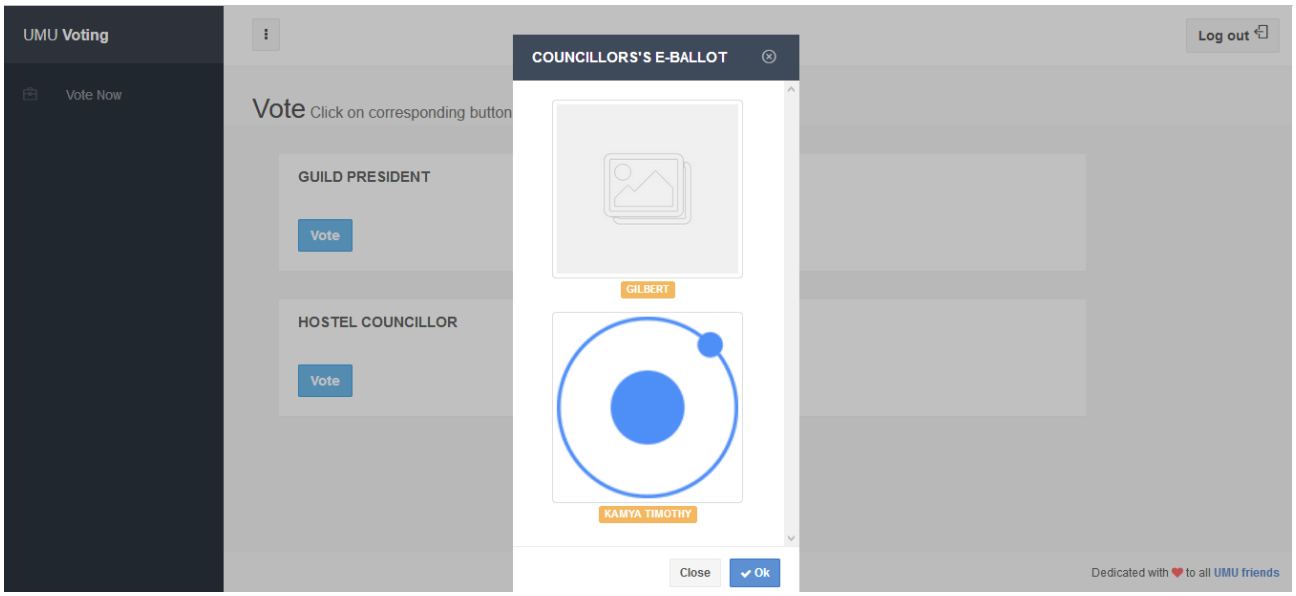

Figure 5.5: The Voting Page

5.2.1 Shortcomings with the System

The System implemented is hindered by the following shortcomings:

There are limited finance resources to fully implement the system.

There is resistance from; commissioners who believe their work was all be done by the tool, and Voters who do not believe it is a secure way to go about with voting online. Power supply to the various areas of the country is not reliable and therefore may deter voters from using the OVS to vote. Just like any other computer based information system, garbage in is garbage out, that is if wrong information is entered to the OVS, so will be the output. There is a significant loss of human touch in the voting process.

5.3 Testing And Validation

Traditional software testing procedures were used for the web-based OVS where testing took place throughout the development process.

Testing involved the execution of system components to evaluate one or more properties of interest. In general, these properties indicated the extent to which the component or system under test:

- meets the requirements that guided its design and development,
- responds correctly to all kinds of inputs,
- performs its functions within an acceptable time,
- is sufficiently usable,
- can be installed and run in its intended environments,
- And achieves the general result the case study desires.

As the number of possible tests for the components is practically infinite, software testing used a strategy to select tests that are feasible for the available time and resources. As a result, testing typically (but not exclusively) attempted to execute the designed system with

the intent of finding software bugs (errors or other defects). The job was an iterative process; when one bug is fixed, it illuminated other, deeper bugs, or even created new ones.

System testing provided objective, independent information about the quality of the system and risk of its failure to users and/or sponsors.

CHAPTER SIX

DISCUSSION, CONCLUSION AND RECOMMENDATION

6.1. Introduction

This section presents the comparison of the project's findings and the manual system.

6.2 Comparison

In the attempt to evaluate the designed system, it is imperative that the researcher look back at the predefined functionalities, goals and objectives and analyze those in relation to the expectations met by the system. The Online voting System was evaluated based on the set of predefined objectives and the expected functionalities it was able to fulfill. The Online Voting System was designed to facilitate efficient voting in Uganda Martyrs Universityl by providing an efficient, reliable computerized Online Voting system and after a careful evaluation process; it met a considerable portion of those expectations.

The main objective was to design a system that enables faster and more efficient storage, retrieval and updating of the university voting records. As far as this is concerned, the system met this expectation by giving direct benefit to the voting section such as fast results retrieval. It also included functionalities that enable all data entrants to access the system online with the assumption that a client-server architecture is in place, retrieve records on demand and execute important reports to support daily voting tasks.

Fundamentally, the effectiveness of this project depended on meeting the project's specific objectives which were as follows;

To carry out a feasibility study for the possibility of developing an online voting system for the University;

To design and develop an online voting system for the voting section of the university;

To test and validate an online voting system for the voting section of Uganda Martyrs University. All the objectives were met by the system, to a certain extent;

Analysis was successfully completed. This evaluation is based on the fact that data requirements were collected and successfully enabled the design and development of the system.

6.3 Opportunities

At the initial stage of the implementation, the administrator was asked to compare the possible advantages of the system in relation to the conventional methods. The following advantages were thus outlined: prevent long queues during students waiting times, it reduces paper work and human errors, proper and safer storage of data.

6.3 Challenges Faced

Many challenges were met during the implementation of the project.

The system was developed and implemented concurrently with other course units the researcher had to accomplish. This led to implementation of the system in parts which were merged later due to time limitation. It could be better than it is if the researcher had got more time.

The changes in climate, that is to say heavy rains resulted into less information collection at some points and some students pretended to be busy and not all students would turn up to for campus.

Understanding key concepts limitations also posed a major challenge. Considering the fact that most of the concepts were new, the researcher had to spend a considerable amount of time learning the concepts. This took away a lot of valuable time that would otherwise be fully dedicated to the design of the system.

Programming skills such as learning PHP and MySQL requires considerable practice for one to gain the programming skills. With limited knowledge and ability, the programming progress was rather slow and this limited the number of functionalities that the researcher could implement into the system.

The researcher was also met with a few financial constraints as a result of unanticipated expenditure. In order to cater for the slow internet speeds in the university computer labs, the researcher had to subscribe for a dial-up internet connection in order to proceed with the project unhindered. This expenditure was however unforeseen and therefore posed a challenge for the researcher.

6.7 Opportunity And Lesson Learned During The Course Of This Project.

I was able to better understand what goes on in the department of the voting system in the University. This was effectively done through direct observation, reading of literature and research. The whole process of developing the system was an opportunistic challenge. Seeing the system into a tangible system was a rewarding exercise.

6.8 Conclusion

In Conclusion, from a proper analysis and assessment of the designed system, it can be safely concluded that the system is an efficient, usable and reliable online voting system. It is working properly and adequately meets the minimum expectations that were set for it initially. The new system is expected to give benefits to the university in terms of increased overall productivity, performance and efficient voting management of Uganda Martyrs University.

6.9 Recommendation

Widening the scope given the limited amount of time given to the developer, the project's scope was rather limited to only voting the union president of the university. The scope can

further be widened to include all the other campuses of the university to make a more integrated comprehensive system that covers the entire university.

A few other components can be included in the system in future. This may include the ability to allow all the university staff members to vote, this will make the system more efficient and drastically increase the amount of functionalities. The ability to include an upload functionality for voters images could greatly enhance the usefulness of the system.

The administrator should train students and staff in order to know how to use the system and dispatch. That is to say students and staff members of Uganda Martyrs University should also be trained on how the system works.

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APPENDICES

APPENDIX I

Research Instruments used;

The interview was semi-structured and it followed the following guideline;

Administrator information

1. When did the Online Voting System start?
2. How is voter's information stored?
3. Do you have any computerized storage system in this section of the university?

Voters Information

1. What problems do you face while using the current system?
2. How long do you take retrieving patients data?

APPENDIX II:

OBSERVATION

This mainly focuses on how services are provided at the voting section of the university;

1. Time taken to register a new voter.
2. How data is stored and retrieved.
3. The amount of work the administrator goes through in a day.
4. The processes that data goes through before and after storage.
5. The level of accuracy of information written by the administrator.