Design & Implementation Of An Electronic Voting System For Christian Service University College

by

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DEDICATION

We dedicate this Thesis to God Almighty our creator, strong pillar, source of inspiration, wisdom, knowledge and understanding. He has been the source of our strength throughout this four year program and on His wings only have we soared.

We also dedicate this work to our parents; who have encouraged us all the way and whose encouragement have made sure that we give it all it takes to finish that which we have started. We wish to dedicate this Thesis with due honour to our guardian, Chief and Lolo Charles Chukwu; who taught us that even the largest task can be accomplished if it is done one step at a time.

To our lovely wives, Rosemond Asare Agyapong, Deborah Ayeebo; who taught us that the best kind of knowledge to have is that which is learned for its own sake. To our siblings, Ernest Kojo Arhin, Marcus Edu Agyapong, and Bright Kusi Agyapong; who have been affected in every way possible by their quest.

And to all who have helped us in diverse ways, we say "A very big thank you to you all." Our love for you all can never be quantified.

God bless you all.

STUDENTS DECLARATION

We the undersigned solemnly declare that the project report, titled **"DESIGN & IMPLEMENTATION OF AN ELECTRONIC VOTING SYSTEM FOR CHRISTIAN SERVICE UNIVERSITY COLLEGE"** is based on our own work carried out during the course of our study under the supervision of **Mr. Phanuel Seli Asense.** We assert the statements made and conclusions drawn are an outcome of our research work. We further certify that:

I. The work contained in the report is original and has been done by us under the general supervision of our supervisor.

II. The work has not been submitted to any other Institution for any other degree/diploma/certificate in this or any other University in the Republic of Ghana or abroad.

III. We have followed the guidelines provided by the university in writing the report.

IV. Whenever we have used materials (data, theoretical analysis, and text) from other sources, we have given due credit to them in the text of the report and giving their details in the references.

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SUPERVISOR'S DECLARATION

I hereby declare that I have read through this project and in my opinion, this project is adequate in terms of scope and quality for the award of the degree of Bachelor of Science in Computer Science.

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ABSTRACT

INTRODUCTION

Electronic Voting has been attracting a lot of interest in the various tertiary institutions in Ghana. This is good as it establishes good administration.

Voting is the process through which individuals convey their opinion and have the freedom to elect a leader of their choice to signify and address the student's issues. We are in the technological age, and problems being solved with the computer are widespread. The use of Electronic Voting Systems to solve election problems both in the country and tertiary institutions is increasing rapidly because it is able to give accurate results, is less costly in the long run, fast and very secure.

PURPOSE

The aim of this project is to present an Electronic voting system (E-Voting) to be applied to Christian Service University College student's electoral body. The system would seek to address issues in the department association elections conducted every year. We intend to achieve this by developing a system that is more secure, speedy and gives an accurate performance. The tools we would use in developing the system would include MYSQL (My Structural Query Language), a relational database management system in designing the database, Javascript, PHP (Hypertext processor) programming language, HTML together with CSS and Ajax; with these, we intend to produce the expected results.

METHOD

Information technology is greatly affecting all areas of our daily lives. In getting leaders to various positions different methods have been set up, with research going into trying to improve them. The most recent method has been electronic voting (e-voting), which is meant to phase out existing methods of voting

FINDINGS

The research findings will generate great awareness about the E-voting system in Christian Service University College and also provide useful knowledge to stakeholders about the benefit of an E-voting system and also provide useful knowledge in policy formulation concerning students' elections.

During the study, we took into consideration descriptive analysis together with qualitative and quantitative data collection approaches. Purposive and simple random techniques were used in the selection and administering of questionnaires to officials of Christian Service University College's Electoral Commission and the voting population from students.

Our findings showed that for a successful E-voting system implementation, Christian Service University College must be willing to accept the new system and do away with the old system, which is the SurveyMonkey and be willing to provide the needed resources as well.

CONCLUSION

It is about time that traditional SurveyMonkey forms for voting in Christian Service University College gives way to the E-Voting system and hence simplifies the task for Electoral commission and his/her Officials.

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Our utmost regard also goes to our parents, guardians; Chief and Lolo Charles Chukwu who diligently support our education in diverse ways. We are and will forever be grateful to you. Words cannot express our profound gratitude to Mr. Phanuel Seli Asense, who has been the ideal project supervisor. His sage advice, insightful criticisms and patient encouragement aided the development of this project in innumerable ways. We would also like to show our profound gratitude to Dr. Thomas Yeboah, Formal Head of Department (Department of Computer Science/IT – CSUC) for his steadfast support in the development of this project. From the depth of our hearts, we also appreciate our wives, Rosemond Asare Agyapong and Deborah Ayeebo who have been there for us through the thick and thin. This page can't tell it all. Please allow us to appreciate our siblings, Ernest Kojo Arhin, Marcus Edu Agyapong, Bright Kusi Agyapong; we love you all.

Finally, we thank our Pastors and Spiritual Heads, Elder Ofori Ahenkora and his wife of Dominion Prayer Warriors Network for their daily prayer support, words of motivation and words of comfort that come in just in time.

We say God bless you all. You all won't lose your reward in Jesus name, Amen.

CHAPTER ONE

INTRODUCTION

BACKGROUND STUDY

Christian Service University College is accredited by the National Accreditation Board. It is affiliated to the University of Ghana, Kwame Nkrumah University of Science and Technology, and the University of Cape Coast. The Hierarchy of Authority at the University comprises of the University Council, Management Board, and Students Representative Council SRC.

Elections at Christian Service University College are conducted periodically to elect representatives of various bodies particularly the Student Representative Council SRC and other associations such as Computer Science Students Association COMSSA, Business Students Association BUSA, and Nursing Students Association NSA, etc.

The electoral system at the university has evolved over the years; from paper-based voting to computerized voting using third party applications, e.g. Monkey Survey. The latter and it challenges notwithstanding, brought great improvement to the electoral process, considering the problems associated with the former, e.g. the inflexible, slow and expensive nature that characterize the printing of ballot papers and sometimes the changes to the voters register when it is close to elections, poses enormous challenges among others.

E-voting is a generic term. It encompasses a variety of services, which includes the basic transmission of tabulated results. It can also include punched cards, optical scan voting systems, specialized voting kiosks, and the transmission of ballots and votes through telephones network, private computer networks, or the internet. When done right will yield many benefits, including speed, cost, trust, flexibility

This project is geared towards among others to bring about transparency of elections so far as the university is concern since it has been noted with great concern among students that, people in high authority pull strings to impose on them leaders they did not elect to bring about a lack of interest among equally qualified candidate for the various offices from contesting. This will increase astronomically the number of contestants for the various offices bringing about competition.

Voting is restricted to users or voters of this system. Not everybody can vote even though users who are not registered voters may have access to the system. In other to vote, one must meet certain requirements and the basic requirement as a student is to be registered or admitted by the school. This automatically qualifies you to partake in the Student Representative Council SRC elections. In the case of Association level elections, the voter must be a student of that Association and admitted student. Access to the system shall be strictly by biometric verification device with username and password as an alternative.

This project was undertaken by John Tanko, Beyin Nana Kwame, and Ahmed Mustapha, students of Christian Service University College are to address the challenges with the current system of voting used over the years.

PROBLEM STATEMENT

Elections at Christian Service University College over the years have not been without one issue or the other. There have been multiples of reported allegation and counter-allegations between contestants and their supporters concerning elections, with mostly losers accusing authorities of election rigging, and other related election malpractices including multiple voting, hacking, etc. in favour of their supposed candidate. This is due to a lack of

transparency before, during, and after elections and the fact that the current system is a third party system.

This can be solved with a properly designed and implemented e-voting system solely owned and managed by the body tasked to handle elections. The design and implementation process should include the student body as well. This will engender trust in the system.

SIGNIFICANCE OF THE STUDY

The significances of E-voting system including:

1) To engender trust among candidates and their supporters before, during, and after elections. Cases of election rigging will be minimized.
2) To provide better services to electorates.
3) To reduce the cost of elections in the long-term.
4) To give assurance to equally qualified candidates to vie for any office knowing they will not be short-changed.
5) To reduce the human factor who can easily be compromised.

OBJECTIVES OF THE STUDY

1) To review the already existing system of voting in Christian Service University College.
2) Designing an electronic voting system for Christian Service University College.
3) Implementing an electronic voting system in Christian Service University College.
4) Validating the System.

JUSTIFICATION OF THE PROJECT

This “E-VOTING SYSTEM” will among others, deduce the mistrust candidates and their supporters have had to deal with before, during, and after elections with the current system of voting. This definitely will increase astronomically the number of the contestant for the various offices advertised fostering competition.

Again, the electorate will be encouraged to go all out to vote for their preferred candidate, knowing it is a fair process.

SCOPE OF THE STUDY

The study focuses on the already existing system of voting in Christian Service University College, Kwame Nkrumah University of Science Technology, University of Ghana, University of Education Winneba, Kumasi campus and to make sure transparency in elections across the board in Christian Service University College.

LIMITATION OF THE STUDY

We having to do all this in a semester posed a lot of challenges due to the limited time period we had in the semester.

Again, we were constrained financially since the entire project was self-sponsored.

MARKET RESEARCH ON PROJECT:

Our research tends out that students prefer our new system to the old one comparing the features of both systems. We also find out that there is no such existing system on campus. The current system on CSUC campus being used for elections is the Monkey Survey, online survey development cloud-based software.

However similar systems are being used by other universities such as Kwame Nkrumah University of Science and Technology (KNUST) which would be studied.

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION

Election process plays a vital role in tertiary institutions and Christian Service University College is no exception. Student Election is a process of electing perfect representatives who will lead the student body. In a democratic country and institution like Christian Service University College, people choose their leaders by giving them valuable votes. The institution in question has a Voting System which has been used for several elections over the years. Recently, it was used to conduct an election for the Student Representative Council (SRC), 2018/2019 executives.

The system has many drawbacks which include the following:

1) The system was created using a survey (www.surveymonkey.com). This system is always created anytime there's an election and destroyed after the election because the system is not owned by the school.

2) The election is done through the internet and thus, without the internet, the voting is stalled.

3) There are no proper records keeping on past elections.

4) The system cannot be used for multiple elections and is too porous in terms of security.

With these drawbacks, there's the need for using a well-designed Electronic Voting System. Voters can vote for their favourite candidates or nominees on a specified Election Day and Date by the Electoral Commissioner (EC).

REVIEW OF OTHER VOTING SYSTEMS

Information Technology is rapidly growing in most developing countries. Many countries including tertiary institutions worldwide are doing away with the manual way of voting with Electronic voting systems (E-voting) that are geared towards increasing voters' participation, protecting votes' votes and expediting the release of election results. Countries like the United States of America (USA), Russia; and tertiary institutions like Kwame Nkrumah University of Science and Technology (KNUST) and University of Ghana, Legon (UG) are examples of countries and institutions that are using e-voting systems for both general and students' elections. The E-Voting Mechanisms (EVMs) used in India statistically shows that there has been the frequent occurrence of invalid votes during elections. Before this system came into use, there were lots of invalid votes recorded and the margin between the winning and losing candidate was very large. The EVMs were developed to eradicate these invalid votes. Apart from this, it also ensured that the results of the election were counted and released within a few hours after voting as compared to the manual means of voting.

REVIEW OF MANUAL VOTING SYSTEM: –

UNIVERSITY OF EDUCATION (UEW), KUMASI CAMPUS

Manual way of conducting students elections in tertiary institutions in Ghana has gone on for some time now and for us to develop a good E-voting system, it deemed necessary to take a critical study on elections conducted locally in care of the students Electoral Commission (EC) of University of Education, Winneba precisely, Kumasi campus. The election process is described as various candidates details printed in the form of a ballot then the Electoral Commissioner sets a date for the election. Various officers working with the Electoral Commissioner sets voting points called Polling Stations where students form a long queue to cast their votes. After the set time for the election to end is due, counting of the ballots takes place where all ballots cast by students (voters) are counted one after the other until the final ballot.

Counting of the ballots mostly delays as the officers are sometimes confused with the numeration or voters do not agree with the number counted that is to say there is no trust in the counting. Tallying of the results takes a longer time as the results in one polling station will be waiting for the result in another polling station to be accumulated. This results in the delay of declaring the final results of the election. It takes about four to five days for the results of the election to be declared. Many of the times, the results declared even are challenged by the losing candidates as they believe there have been some infringements somewhere. Fig 2.1 shows a step by step overview of a manual election at the University of Education, Winneba.

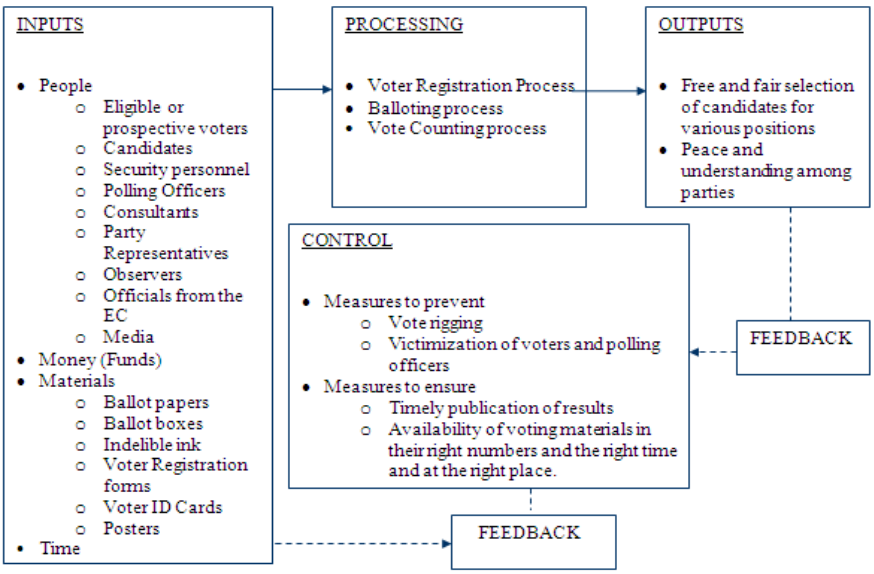


Fig.2.1: Manual voting system - (University of Education, Winneba)

REVIEW OF OTHER EXISTING E-VOTING SYSTEMS: KNUST & UG

In this section, we review the performance of some e-voting systems already existing, with bases been their availability, access to the system and security. When developing any system including E-Voting system, user requirements are the primary objectives, the reason being that you cannot develop a perfect system without these requirements. Security is essential in this case.

There are numerous electronic voting systems on the internet, youtube and local tertiary institutions like the Kwame Nkrumah University of Science & Technology (KUNST), University of Ghana (UG), to mention but few which were developed by professional Software Engineers.

Encryption schemes via public key infrastructure and certificate are the most widely based on voting data and process security. This can be used together with biometric for secure authentication. The trust and success of the system cannot be achieved without a good and

strong security. The voting process, channels, data, communication channel, access control channel and all other voting tools and technologies need to be secured. Why we have to secure all these levels is that security in the E-voting system cannot be at one level; if we decide to secure only one level, we make the other levels very weak. Such systems are left at the mercies of hackers.

KWAME NKRUMAH UNIVERSITY OF SCIENCE & TECHNOLOGY –

KNUST, KUMASI.

The institution uses one platform for all elections conducted on campus; from SRC, associations to university authority's elections. About seven (7) years ago, the university faced a lot of challenges in electing leaders in the various organizations and as such there was the need for the introduction of an E-Voting System.

STRENGTHS OF THE SYSTEM

Their system had good strengths considering the following:

1) The system could be used to conduct two different elections at the same time.
2) The system could keep proper records of past elections.
3) The Electoral Commissioner (EC) is able to see and assess all computers on the network that are being used for the election and as such any foreign computer connected to it is detected easily.
4) In terms of security, it is highly secured with the use of a biometric fingerprint device which makes sure it is the right voter coming to vote.
5) There is no room for double voting as the verified voter can vote only once.

DRAWBACKS OF THE SYSTEM

The drawbacks of the system were as follows:

1) The voter cannot vote at a place or on a device that does not have a fingerprint scan for verification.
2) Apart from the computers used at various polling stations for elections, no voter or whomsoever can connect other devices to the system and use for voting since all computers provided by the EC on election day are configured with IP addresses. Therefore the system is made to accept only votes coming from those computers.
3) Although the system is web-based, it cannot work outside the university's campus.

UNIVERSITY OF GHANA, LEGON – UG, ACCRA.

The University of Ghana started using the E-Voting system for SRC elections about eight (8) years ago. The system uses the Student's ID Number for login and vote verification. The system seems to accumulate the votes and display the final results within a few seconds after the close of the election.

STRENGTH OF THE SYSTEM

Their system had good strengths considering the following:

1) The system accepts votes from a given range of Students ID Numbers. With this, any number not found with the given range of numbers by EC is rejected by the system.
2) Right after the voter has finished casting his/her votes, the results of the entire election are shown to him/her.
3) Since it's web-based, students can access it at their place of convenient within the university's campus provided they have their credentials to login without going to the polling stations to queue.

DRAWBACKS OF THE SYSTEM

The drawbacks of the system were as follows:

1) Although the system is web-based, it cannot work outside the university's campus.

2) Vote manipulation. Regardless of which candidates one vote for, the EVS is programmed to credit a specific candidate with all the votes from voters whose identification numbers end with an even number whilst votes cast by voters whose identification numbers end with an odd number are shared equally between the two candidates.

3) The system allowed for double voting.

From all the systems studied, we think that of KNUST is the best and that we used it as our case study. The major problems with EVS are security and double voting. In terms of security, we are looking at verification, authentication, and denial-of-service (DoS). In this system, authentication and verification are done by a biometric device or a student email address and a password. Only verified voters are allowed to vote or voters whose fingerprints fail to be verified by the biometric device but are registered voters are authenticated using their student's email address and password.

PROPOSED FRAMEWORK FOR A SECURE E-VOTING SYSTEM.

The development of an e-voting system that gives universal access to all voters eligible provides strong security architecture, and integrity of the voting process is the focus of this study. A hybrid electronic voting system that combines Direct-Recording Electronic (DRE) and online electronic voting system, with online and offline voting capabilities is what we propose.

This consists of a platform, where, where operating systems, servers, network, memory, and other hardware resources are provided by the cloud provider. Voting shall be done online considering that it is a cloud application. Eligible voters in areas where there is no internet connectivity, a polling kiosk, shall be provided with a computer, the results shall after be synchronized with the cloud. There is also logging every process for auditing purposes, with flexibility in the choice of voting mechanism.

TYPES OF VOTING SYSTEMS

In recent years, voting equipment which was widely adopted in many countries for voting may be divided into eight (8) types, namely:

1) Paper-Based Voting Systems (PVS)
2) Direct-Recording Electronic (DRE) Voting Systems
3) Lever Voting Machine (LVM)
4) Punch Card Voting Machine (PCVM)
5) Public Network DRE Voting Systems (PNDRE)
6) Optical Voting Machine (OVM)
7) Precinct Count Voting Systems (PCVS)
8) Central Count Voting Systems (CCVS)

PAPER-BASED VOTING SYSTEMS (PVS)

With this system, the voter is giving a blank ballot and with a pen or a marker so he/she indicates the candidate of choice. The counting, recording, and tabulation of the votes cast are undertaken manually, which is a time and labour-consuming process. Paper-based ballots can produced and kept for verification; it is still the most common way to vote.

DIRECT RECORDING ELECTRONIC (DRE) VOTING SYSTEMS

This system which is abbreviated to DRE integrates with a keyboard; touch screen or buttons for the voter to press to a poll. Recording or votes and ballots with images are done in a computer's memory in this type of system. Most of these types of systems are quick in counting and recording of votes.

LEVER VOTING MACHINE (LVM)

This is unique equipment, made of various levels that link the various candidates. The lever is pulled when the voter wants to vote for a candidate. It is not user-friendly even though it automatically counts up the ballots, there's the need to give voters thorough training prior to the election.

PUNCH CARD VOTING MACHINE (PCVM)

With this type of system metallic hole-punch is used by the voter to punch a hole on the blank ballot during an election. Counting of the votes and ballots are done automatically, nevertheless, the voters' preferred chosen candidate maybe wrongfully determined by the system.

PUBLIC NETWORK DRE VOTING SYSTEMS (PNDRE)

This system makes use of electronic ballots and transmits vote data from the polling stations to other locations over a public network. Transmission of votes may be done in several ways, for example; ballots may be transmitted individually as and when they are cast by voters, it can also be in groups transferred periodically, it can also be transferred all at once when the voting is over.

OPTICAL VOTING MACHINE (OVM)

With this type of machine, the voter picks a blank ballot and fills a circle that corresponds to a candidate. The machine picks each ballot and selects the darkest mark on it as a vote and then calculates all as a result. Counting of ballots is done very fast but an error may occur during the optical-scan when the voter fills over the circle

PRECINCT COUNT VOTING SYSTEMS (PCVS)

The ballots are put in a tabular form, with provided mechanisms to store votes cast electronically and transmit the same over a public telecommunication network to a central location.

CENTRAL COUNT VOTING SYSTEMS (CCVS)

It puts together ballots tabulated from multiple PCVS at a central location, with votes cast stored safely temporarily at the polling station and transmitted to a central location.

CHARACTERISTICS OF A VOTING SYSTEM

Firstly, voters' ballot must remain anonymous. This is so that, voters are safe from attacks from candidates voted against

Secondly, the system of voting must not prone to security threats. It must be a system that is secure against all manner of threats.

Thirdly, the system should be user-friendly. It should be easy to navigate through with little or no assistance.

PARTITIONS OF THE E-VOTING SYSTEM (EVS)

The EVS is partitioned into two (2) panels on the basis of its users as follows:

Admin Panel: This panel will be specifically used by members of the electoral commission to administer all the electoral processes including registrations of candidates and voters and monitor all other actions carried out by them.

Student/Voter Panel: This panel will be specifically used by each individual voter who is eligible for casting his/her vote. Each and every student has two (2) votes. That is one vote for SRC elections and another for a Department election.

CONCLUSION

In conclusion, we have reviewed the current system in Christian Service University College, reviewed the voting systems in other tertiary institutions like Kwame Nkrumah University of Science and Technology, University of Education and the University of Ghana. In the next chapter, we will be looking at the methodology in developing the proposed system.

CHAPTER THREE

THE METHODOLOGY

INTRODUCTION

In chapter one, we spoke about the need for a new E-voting system. This chapter presents how data is collected (User requirements gathering), the review of the old or already way of voting and a proposed system to be. The methods used to achieve the objectives of the project are included. Requirements needed for the implementation of the system and a short reason as to why these methods were chosen. The approach for the development of the project will be the Waterfall model.

SYSTEM ANALYSIS

The objective is to determine the requirements for the proposed system, which thus involve three tasks; Data gathering through observation, interviews, and questionnaire, etc., analysis with tools such as a checklist, and decision tables, and documentation

DESCRIPTION OF THE EXISTING VOTING SYSTEM

Here, we would talk about the existing system and its associated problems.

Although the existing system of voting is web-based, the Electoral Commissioner of Christian Service University College captures data through registered students. It has no period of registration for voters. Every student has a Student Identification (ID) Number, a Student email address and a system-generated password. Students are identified by their students' ID numbers and access their accounts using their students' email addresses and passwords.

MODEL OF THE CURRENT SYSTEM

To the best of our knowledge, during elections, the EC of CSUC creates a form through a survey called the SurveyMonkey (www.surveymonkey.com) for a particular association which wants to run elections, eg. Student Representative Council. The association pays not less than Three Thousand Ghana Cedis (GHC3,000.00) to the IT department to create the form for the EC to conduct the election. Even with this, the form is always destroyed after the election and recreated whenever there's an election. The survey created for election is then linked to the school's database which has the registered students. Students or Voters are able to access the system by clicking on a link sent to their students' email addresses. The link then sends them to the SurveyMonkey page where they are able to vote for their favorite candidate. After the elections, the form is destroyed and no records are kept for future reference.

USE CASE DIAGRAM SHOWING ELECTION PROCESS AT CHRISTIAN SERVICE UNIVERSITY COLLEGE USING THE EXISTING SYSTEM

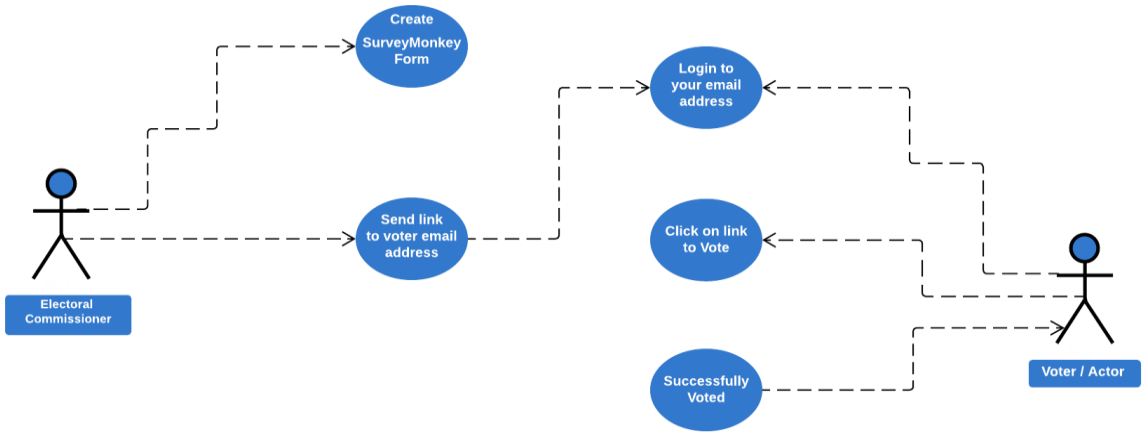


Fig. 3.1: Election process at CSUC

SOLUTION MODEL OF THE PROPOSED SYSTEM “TO BE” MODEL

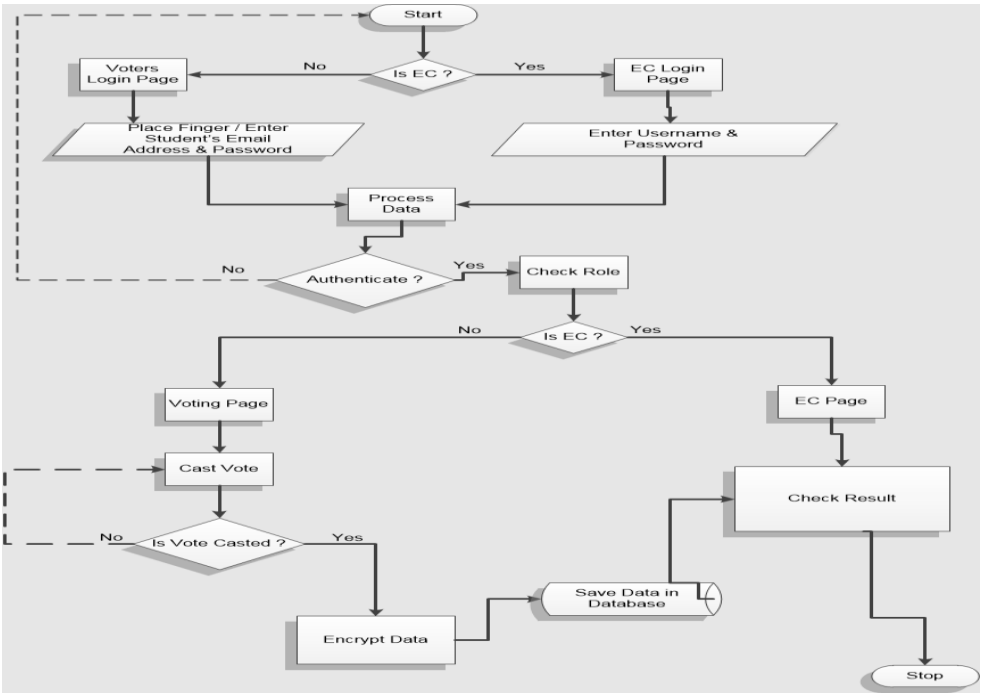


Fig. 3.2: *A diagram indicating the solution model of the proposed system “to be”.*

DETAILED NETWORK DIAGRAM OF THE PROPOSED SYSTEM "TO BE."

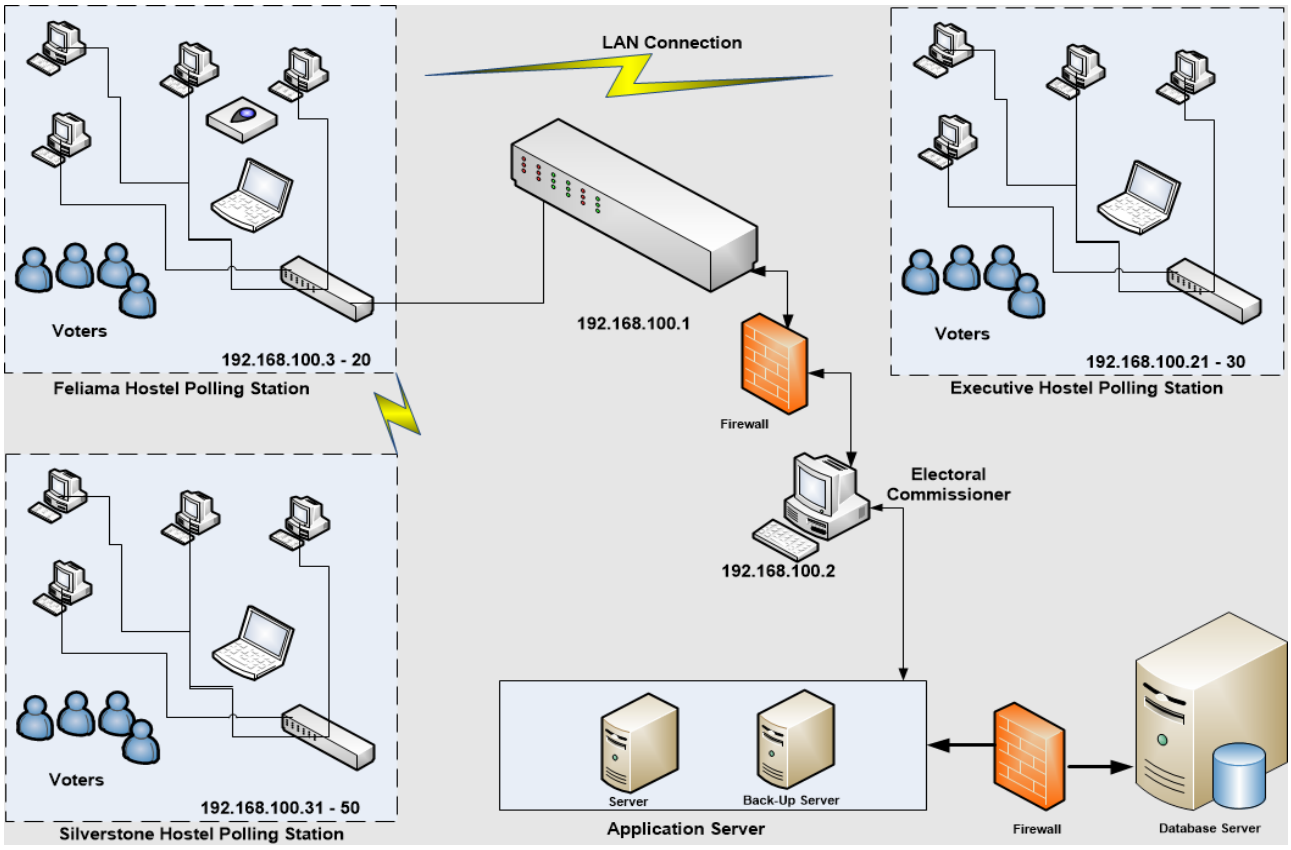


Fig. 3.3: *Detailed diagram of the proposed system "To Be".*

INCREMENTAL MODEL

This project was developed based on the Incremental Model. The incremental focuses on building the whole system in small portions. These when done are put together and delivered as a model.

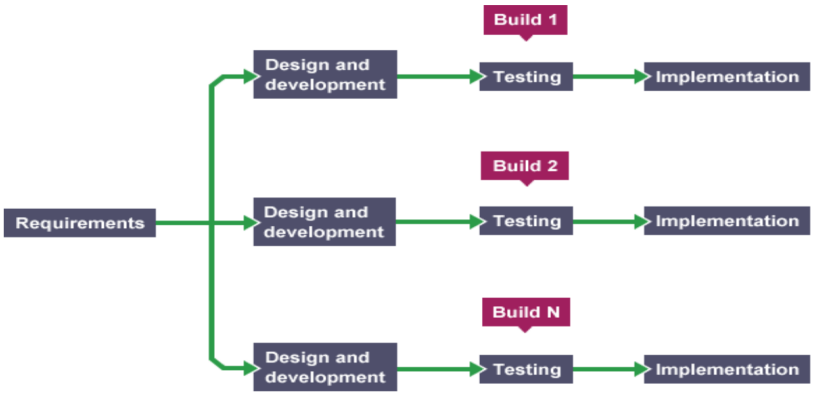


Fig. 3.4: Incremental Model Diagram

SYSTEM SPECIFICATION AND DESIGN

Specifications

User Requirements for the Proposed System to be

The Electronic Voting System should:

1) Be able to display to the System Administrator or Electoral Commissioner the total number of voters in the system.

2) It should be user-friendly, with guides that will be understandable to all voters.

3) It should be robust enough in other not to encounter problems in the cause of voting.

4) It should support concurrency voting. That is, multiple users can vote at a time from different locations without encountering problems now and in the near future.

REQUIREMENT SPECIFICATION

For an efficient Electronic Voting System, the following requirements must be met:

1) Browsers: We have browsers like Firefox, Chrome, Internet Explorer and Opera. The database used is MYSQL Database Management System. We also used XamppServer for testing. The languages used were HTML, PHP, JavaScript, Ajax, and CSS.

2) Software: Windows Operating System, from Windows XP to later versions.

3) Hardware: At least 1.6 GHz Processor Speed, 40 GB Hard Disk Capacity or more and 512 RAM or more.

FUNCTIONAL REQUIREMENTS

1) Secure storage and retrieval of voters' details from the database.

2) Enable secure login of voters, that is to say, no- legitimate voters should not be allowed to log in to the system.

3) Be able to validate input and verify output of data.

DESIGN AND IMPLEMENTATION TECHNOLOGIES OF SYSTEM

The E-voting System is developed as an intranet voting system to offer users convenient access to voting. Several tools used during implementation include the following:

SOFTWARE

1) MYSQL DBMS: – This allows for easy querying of the database using the select, insert, delete, and update. This type of database is self-dependent and works on various platforms which includes Mac OS, Microsoft Windows, Linux, to mention but few and works together with all hardware as well. To achieve good results, it is very fast stable and is very cheap compared to other databases.

2) HTML: – The heart of the internet (World Wide Web) nowadays is the Hypertext Markup Language (HTML). Sublime Text editor 3 (as at the time of developing the system) is the preferred editor for coding the various User Interface (UI) designs in the E-voting system.

3) Personal Home Page (PHP): – PHP language was the preferred language for coding the various functions of the E-voting system.

4) JavaScript - As a scripting language was also used.

5) Ajax – It synchronizes the web browser.

6) CSS – For styling the user interface.

7) Testing is done via XAMPP SERVER.

8) We used browsers like Firefox, Chrome, Internet Explorer and Opera to test the system.

9) Chart API for displaying the results.

HARDWARE

For the system to run effectively, the hardware must meet the following specifications:

1) a computer with at least 1.6 GHz CPU speed for optimum performance,

2) at least 40 GB Hard Disk Capacity,

3) 512 RAM and

4) a Printer.

SYSTEM DESIGN

THE LOGIN FLOWCHART

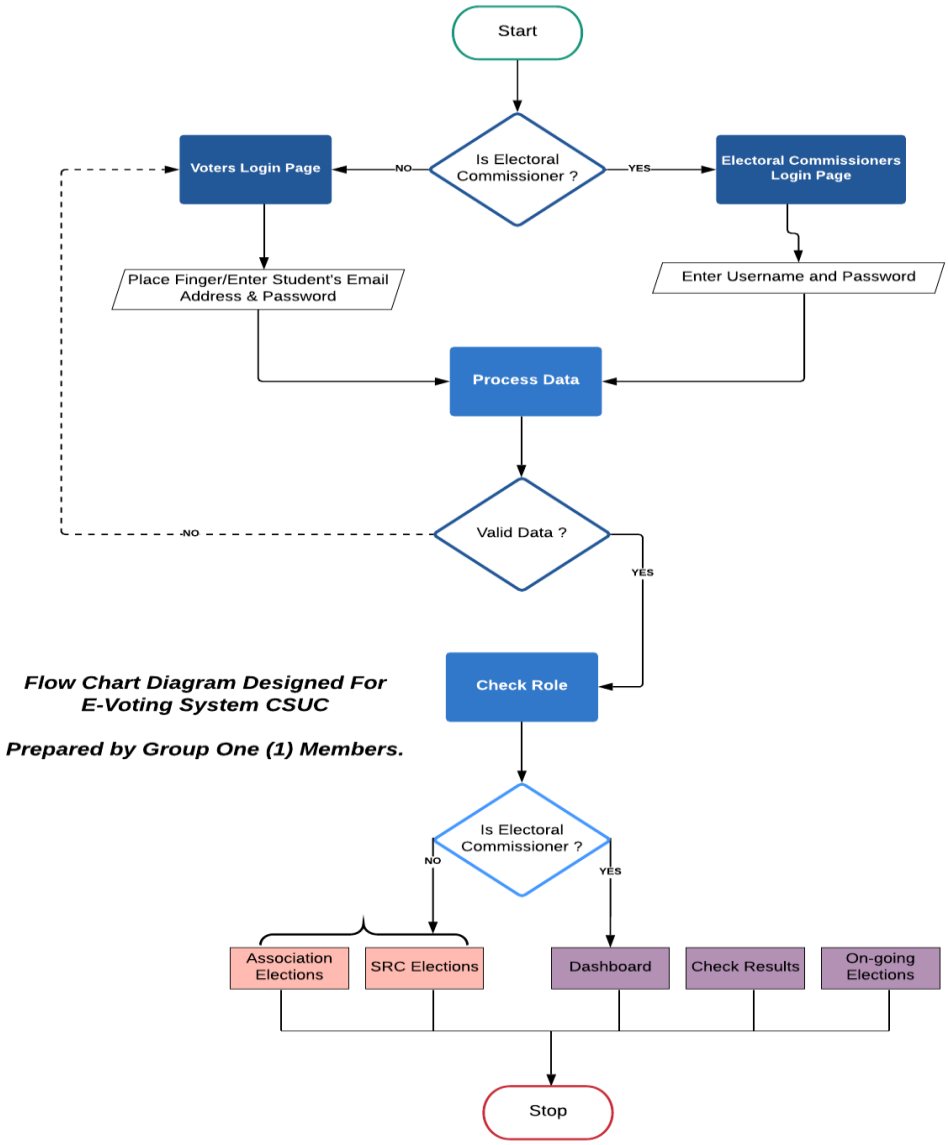


Fig. 3.5: Login Flow chart

Note that for one to experience the administrator's privilege, he/she must login as the Electoral Commissioner with the commissioner's username and password which is kept secret / confidential at all costs.

DATABASE DESIGN

The system has a backend database with the name “voting” which is made up of ten (10) tables or entities which are shown below;

The various tables of “Voting”

	a_id	associa	dept	startTime	endTime	status
Edit Copy Delete	1	SRC	ALL (SRC)	2019-04-16 07:00:00	2019-04-16 07:00:00	1
Edit Copy Delete	2	COMUSA CSUC	BSc Communication Studies	0000-00-00 00:00:00	0000-00-00 00:00:00	2
Edit Copy Delete	3	NSA CSUC	BSc Nursing	0000-00-00 00:00:00	0000-00-00 00:00:00	2
Edit Copy Delete	4	COMSSA CSUC	BSc Computer Science/IT	0000-00-00 00:00:00	0000-00-00 00:00:00	1
Edit Copy Delete	5	BUSA CSUC	BSc Business Admin	0000-00-00 00:00:00	0000-00-00 00:00:00	1
Edit Copy Delete	17	GRASA	BSc Computer Science/IT	0000-00-00 00:00:00	0000-00-00 00:00:00	2
Edit Copy Delete	19	GhanaMed	BSc Business Admin	0000-00-00 00:00:00	0000-00-00 00:00:00	2
Edit Copy Delete	20	OK FM	BSc Computer Science/IT	0000-00-00 00:00:00	0000-00-00 00:00:00	2
Edit Copy Delete	21	ALICO ex	BSc Nursing	0000-00-00 00:00:00	0000-00-00 00:00:00	2
Edit Copy Delete	22			0000-00-00 00:00:00	0000-00-00 00:00:00	2

Fig 3.6: *Assoc table indicating the records of all associations on campus.*

	id	username	password	fname	lname	oname	role
Edit Copy Delete	1	admin	admin	Marcus	Kusi		Electoral Commissioner
Edit Copy Delete	2	ecadmin	password	Henry	Asare	Kwame	Electoral Commissioner

Check all With selected: Edit Copy Delete Export

Fig 3.7: *EC table indicating all records elected electoral commissioners.*

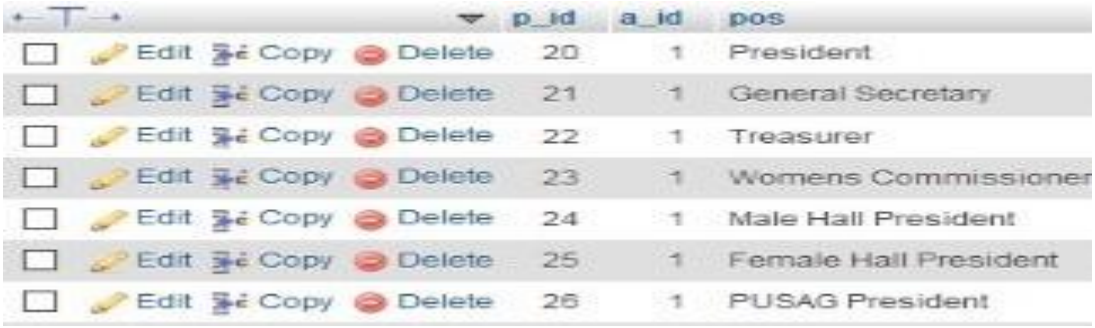
	e_id	e_year	start_date	end_date	n_id
Edit Copy Delete	1	2018/2019	2019-05-24 20:16:51	2019-05-24 20:16:51	54
Edit Copy Delete	2	2018/2019	2019-05-24 20:16:51	2019-05-24 20:16:51	60

Check all With selected: Edit Copy Delete Export

Fig 3.8: *Elections table indicating all records of past elections.*

	n_id	a_id	p_id	fname	oname	lname	prog	year	pic
Edit Copy Delete	54	1	20	Henry	N.	Agyapong	BSc Computer Science/IT	2019 / 2020	../assets/img_upload/5c60aa49a72d68.84730811.jpg
Edit Copy Delete	55	1	20	John		Tanko	BSc Computer Science/IT	2019 / 2020	../assets/img_upload/5c60aa72e26bf1.03652391.jpg
Edit Copy Delete	56	1	21	Mary	Osei	Ansah	BSc Nursing	2019 / 2020	../assets/img_upload/5c60aab48b2585.74269691.png
Edit Copy Delete	57	1	21	Bright	K	Ampong	BSc Business Admin	2019 / 2020	../assets/img_upload/5c60aaeab58fb1.86949561.jpg
Edit Copy Delete	58	1	22	Ahmed		Mustapha	BSc Nursing	2019 / 2020	../assets/img_upload/5c60ab2a266eb2.83084321.jpg
Edit Copy Delete	59	1	23	Asare	A	Rose	BSc Nursing	2019 / 2020	../assets/img_upload/5c60ab55c93193.08132826.jpg
Edit Copy Delete	60	1	24	Evans		Allotey	BSc Communication Studies	2019 / 2020	../assets/img_upload/5c60ab84e06268.13598114.png
Edit Copy Delete	61	1	25	Doris		Amos	BSc Theology	2019 / 2020	../assets/img_upload/5c60ae07aa8e11.23097401.jpg
Edit Copy Delete	62	1	26	Francis	Kofi	Essel	BSc Business Admin	2019 / 2020	../assets/img_upload/5c60ae55b780f5.42762048.png
Edit Copy Delete	64	4	28	Ahmed		Mustapha	BSc Computer Science/IT	2019 / 2020	../assets/img_upload/5cb82fd180bb12.74229070.jpg
Edit Copy Delete	65	5	32	Robert	Arhin	Sackey	BSc Business Admin	2019 / 2020	../assets/img_upload/5cb8a153e9e6c0.68584913.jpg
Edit Copy Delete	66	5	34	Alberta		Sarpong	BSc Communication Studies	2019 / 2020	../assets/img_upload/5cb8a46f6267e0.14920399.png
Edit Copy Delete	67	5	34	Alberta		Sarpong	BSc Communication Studies	2019 / 2020	../assets/img_upload/5cb8a7279a9916.16604144.png
Edit Copy Delete	68	4	29	Alex		Allotey	BSc Nursing	2019 / 2020	../assets/img_upload/5cc043f2882023.47046287.jpg
Edit Copy Delete	69	4	30	Eric	O	Lamptey	BSc Theology	2019 / 2020	../assets/img_upload/5cc044dc5c6a38.35171789.jpg
Console t Copy Delete	70	4	31	George	M	Asante	BSc Business Admin	2019 / 2020	../assets/img_upload/5cc0454dd81343.53373929.png

Fig 3.9: *Nominees table indicating all records of aspirants.*



	p_id	a_id	pos
Edit Copy Delete	20	1	President
Edit Copy Delete	21	1	General Secretary
Edit Copy Delete	22	1	Treasurer
Edit Copy Delete	23	1	Womens Commissioner
Edit Copy Delete	24	1	Male Hall President
Edit Copy Delete	25	1	Female Hall President
Edit Copy Delete	26	1	PUSAG President

Fig 3.10: *Positions table indicating all records of aspirants and their positions.*

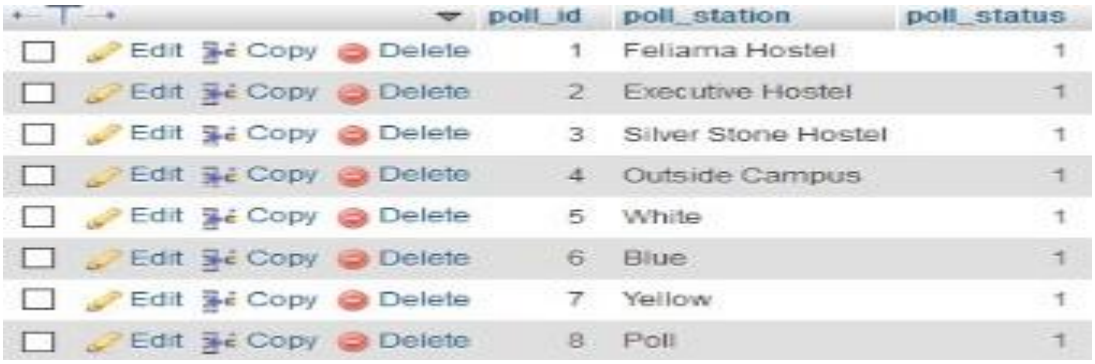
	voterid	a_id	fname	oname	lname	prog	year	stud_id	password	counter	poll_id
Edit Copy Delete	60	4	Henry	N.	Agyapong	BSc Computer Science/IT	2019 / 2020	nbeyin@stu.csuc.edu.gh	$2y$10$b5NBGvsmJPTfnBiKELYAdOI0TIEq2ibgLzAc4fDvFTL...	1	2
Edit Copy Delete	61	1	Henry	N.	Agyapong	BSc Computer Science/IT	2019 / 2020	nbeyin@stu.csuc.edu.gh	$2y$10$b5NBGvsmJPTfnBiKELYAdOI0TIEq2ibgLzAc4fDvFTL...	1	2
Edit Copy Delete	62	5	John		Tanko	BSc Business Admin	2019 / 2020	jtanko@stu.csuc.edu.gh	$2y$10$VztsV1AAV69zFGvZUx2e0.1LwYDolC0HhXccMbwIpy0...	1	1
Edit Copy Delete	63	1	John		Tanko	BSc Business Admin	2019 / 2020	jtanko@stu.csuc.edu.gh	$2y$10$VztsV1AAV69zFGvZUx2e0.1LwYDolC0HhXccMbwIpy0...	1	1

Fig 3.11: *Voters table indicating all records of registered students/voters.*

	v_id	nominees_id	voters_id	associa	pos
Edit Copy Delete	39	0	61	SRC	President
Edit Copy Delete	40	57	61	SRC	General Secretary

Check all With selected: Edit Copy Delete Export

Fig 3.12: *Votes table indicating all records of the various votes casted by voters.*

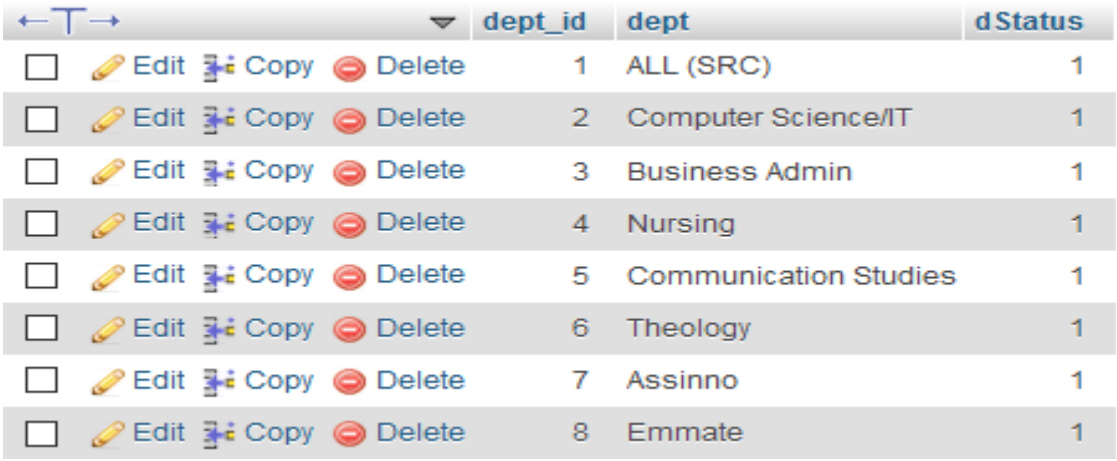


	poll_id	poll_station	poll_status
Edit Copy Delete	1	Feliama Hostel	1
Edit Copy Delete	2	Executive Hostel	1
Edit Copy Delete	3	Silver Stone Hostel	1
Edit Copy Delete	4	Outside Campus	1
Edit Copy Delete	5	White	1
Edit Copy Delete	6	Blue	1
Edit Copy Delete	7	Yellow	1
Edit Copy Delete	8	Poll	1

Fig 3.13: *Poll table indicating all records of polling stations.*

	pc_id	poll_id	pcName	ip_address	mac_address
Edit Copy Delete	1	1	Computer 1	192.168.100.10	2adm3nwwwww234
Edit Copy Delete	2	1	Computer 2	192.168.100.11	4e3335rr6t777778iknmmm
Edit Copy Delete	3	2	Computer 3	192.168.100.20	120pppmmmdc98okuj
Edit Copy Delete	4	2	Computer 4	192.168.100.50	203pmctttnnyio567n
Edit Copy Delete	5	4	Computer 9	192.162.90.11	FF-FFF-22-44-55
Edit Copy Delete	6	4	Computer 9	192.162.90.11	FF-FFF-22-44-55
Edit Copy Delete	7	3	Computer 8	192.168.100.200	AAA-FF-22-33-444
Edit Copy Delete	8	3	Computer 10	192.168.100.300	FF-FFF-22-44-55-SS-000

Fig 3.14: *PC table indicating all records of computers connected in all polling stations.*



	dept_id	dept	dStatus
Edit Copy Delete	1	ALL (SRC)	1
Edit Copy Delete	2	Computer Science/IT	1
Edit Copy Delete	3	Business Admin	1
Edit Copy Delete	4	Nursing	1
Edit Copy Delete	5	Communication Studies	1
Edit Copy Delete	6	Theology	1
Edit Copy Delete	7	Assinno	1
Edit Copy Delete	8	Emmate	1

Fig 3.15: *Department table indicating all records of the various departments in CSUC.*

ENTITY RELATIONSHIP DIAGRAM

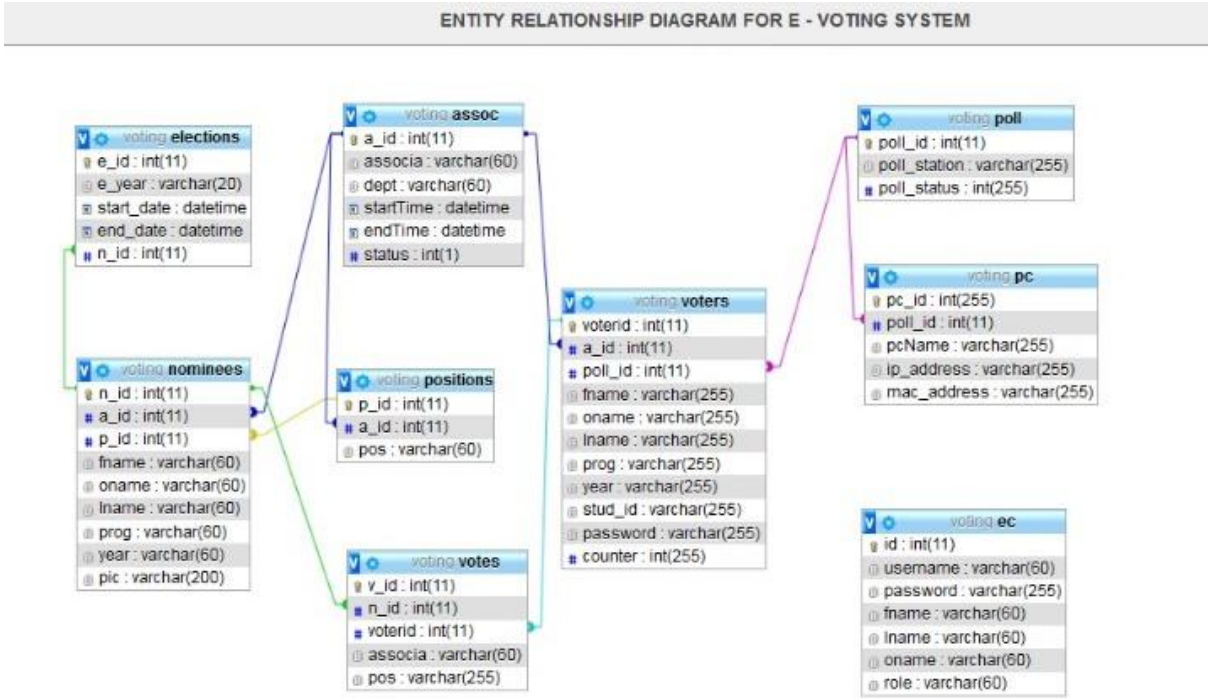


Fig 3.16: *Entity relationship diagram of the Proposed System "to be".*

SAMPLE CODE.

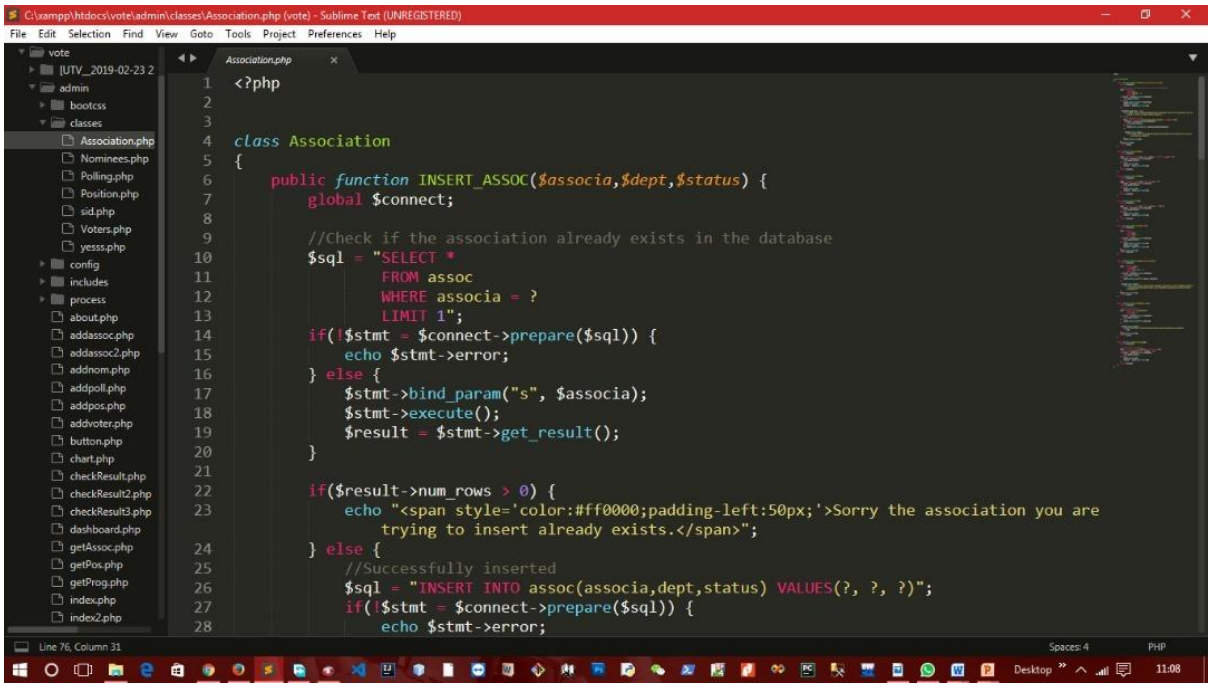


Fig 3.17: *Sample code for association.*

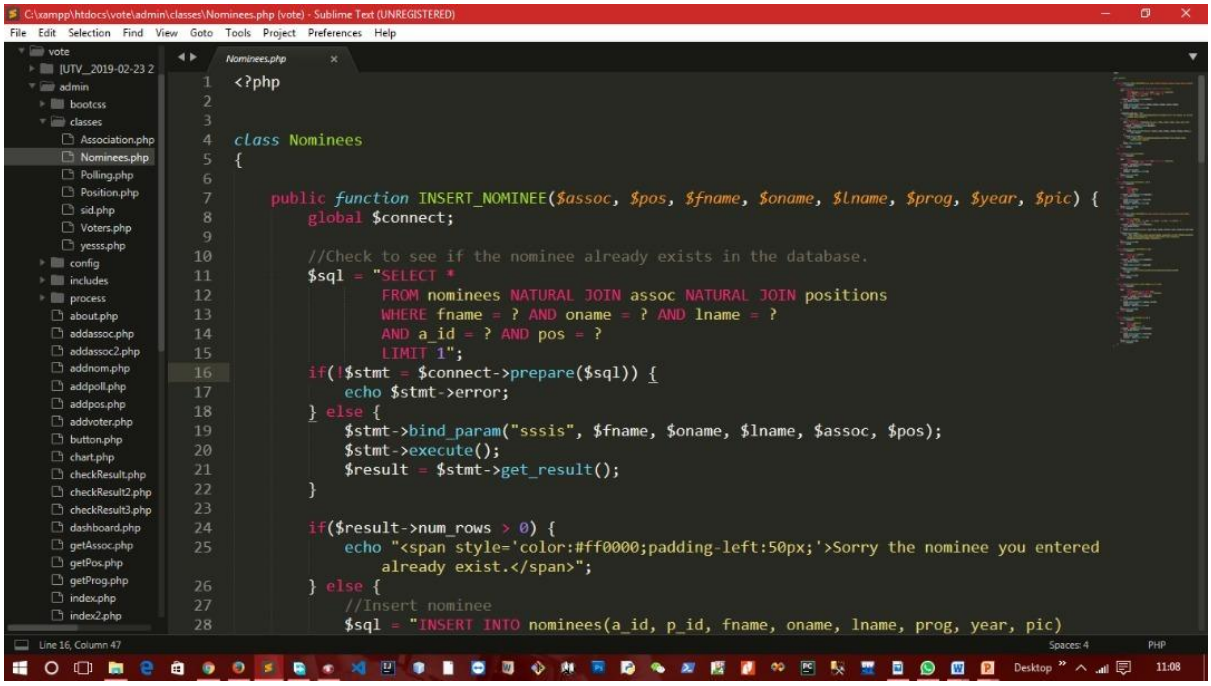


Fig 3.18: *Sample code for nominees.*

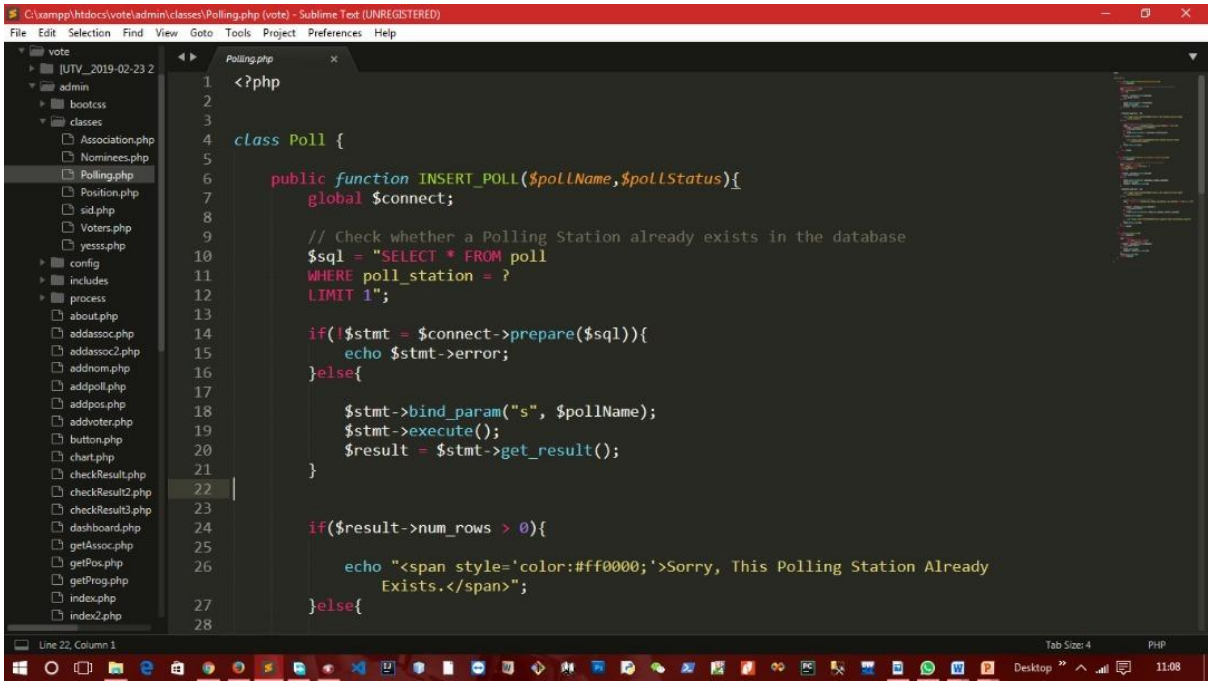


Fig 3.19: *Sample code for polling station.*

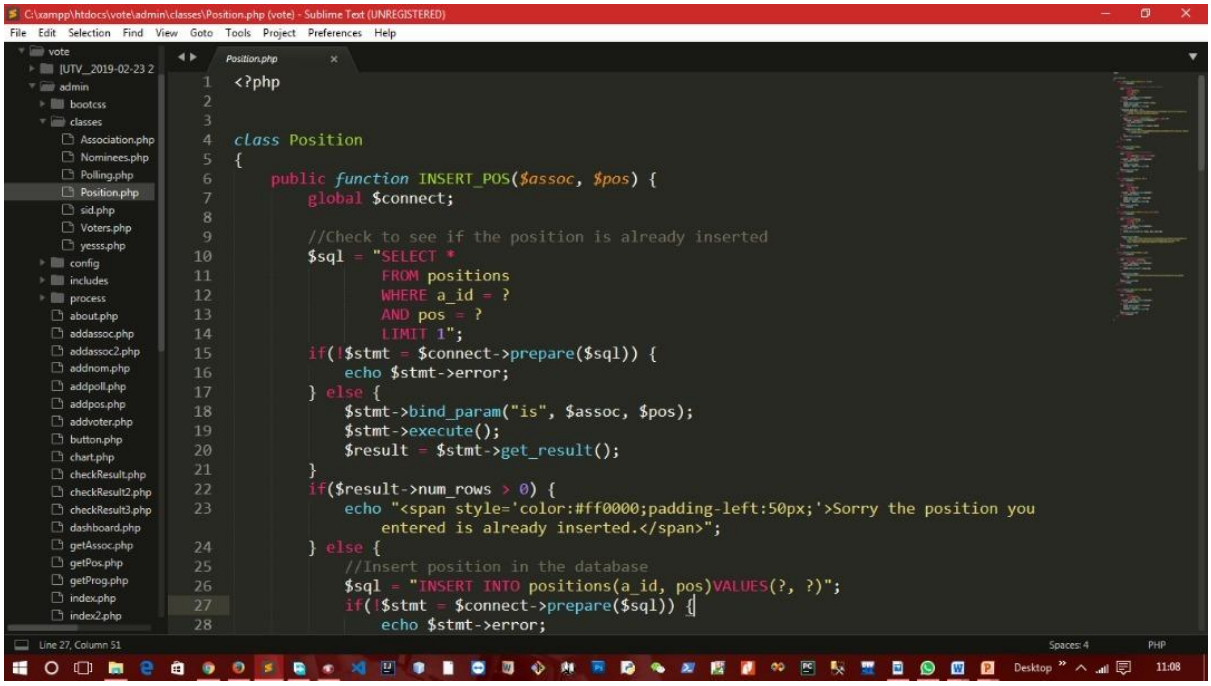


Fig 3.20: *Sample code for position.*

CONCLUSION

In this chapter, we looked at the methodology in developing the proposed system “to be”, the solution model “to be”, system design and implementation technologies as well as the database design and coding. The result of the design and coding will be looked at in chapter four.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

INTRODUCTION

This chapter presents the results of the project and its discussions. The objective of this project was to review the existing system, develop and implement an E-voting system in Christian Service University College. A review of similar systems was conducted in other to improve upon the existing system. Feasibility study, requirement gathering, analysis, design, coding, and testing of the new system were also conducted.

TESTING OF THE SYSTEM

After testing the various modules of the new system, the results were as follows:

If the user or voter wants to use the system for the very first time, he/she will see the following interface;

VOTERS USER INTERFACE

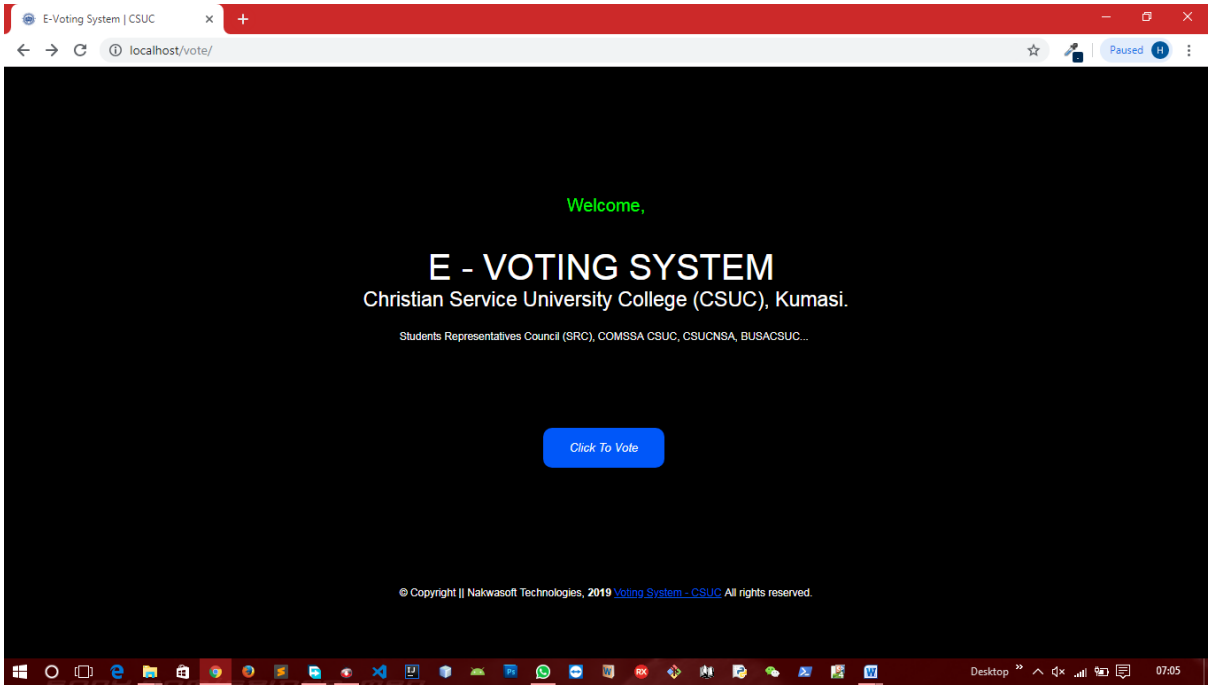


Fig 4.1: *Welcome page.*

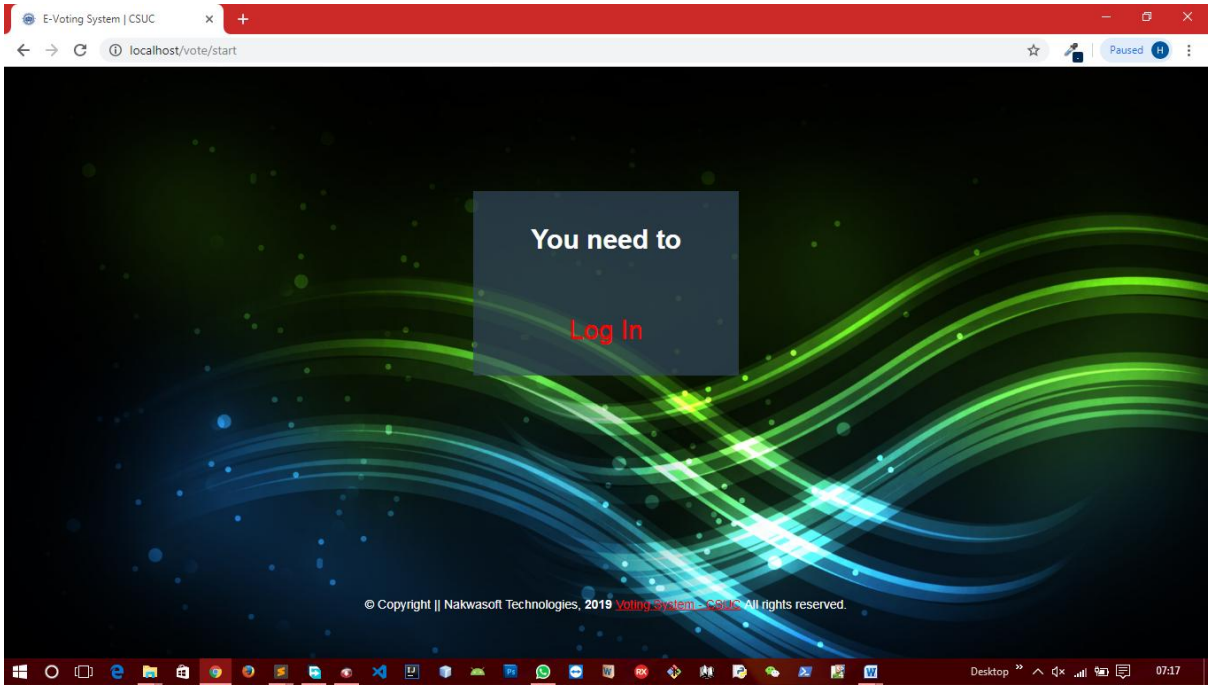


Fig 4.2: *Request page.*

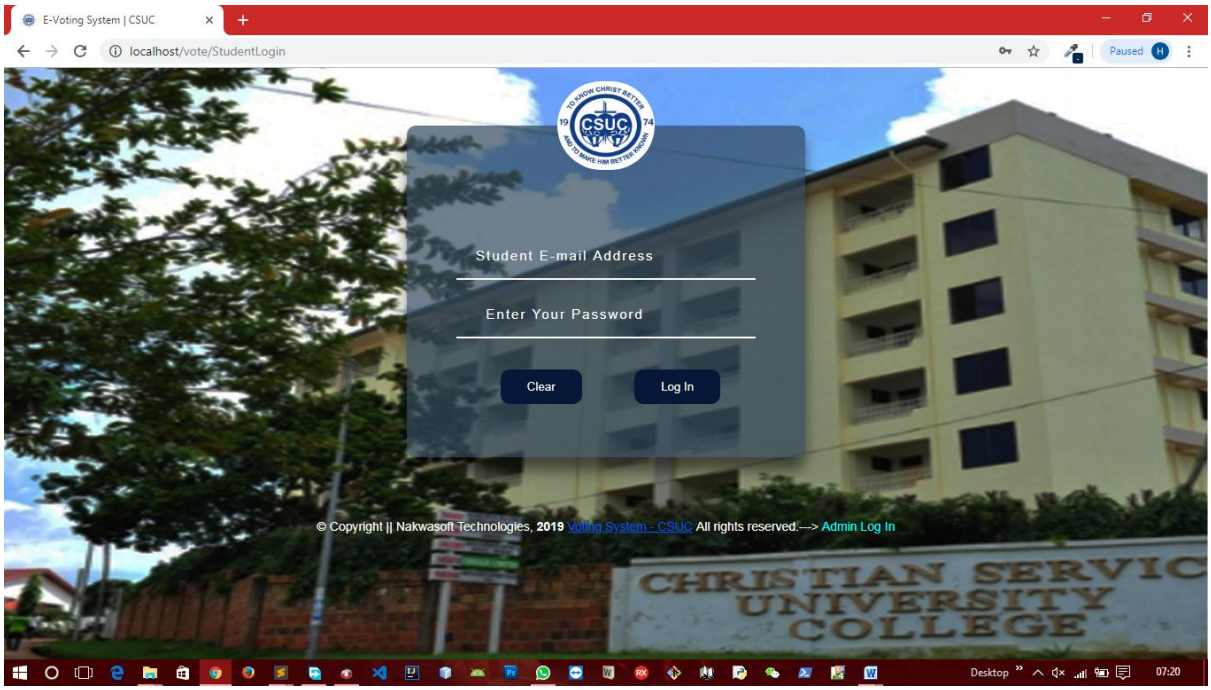


Fig 4.3: *Voter's login page.*

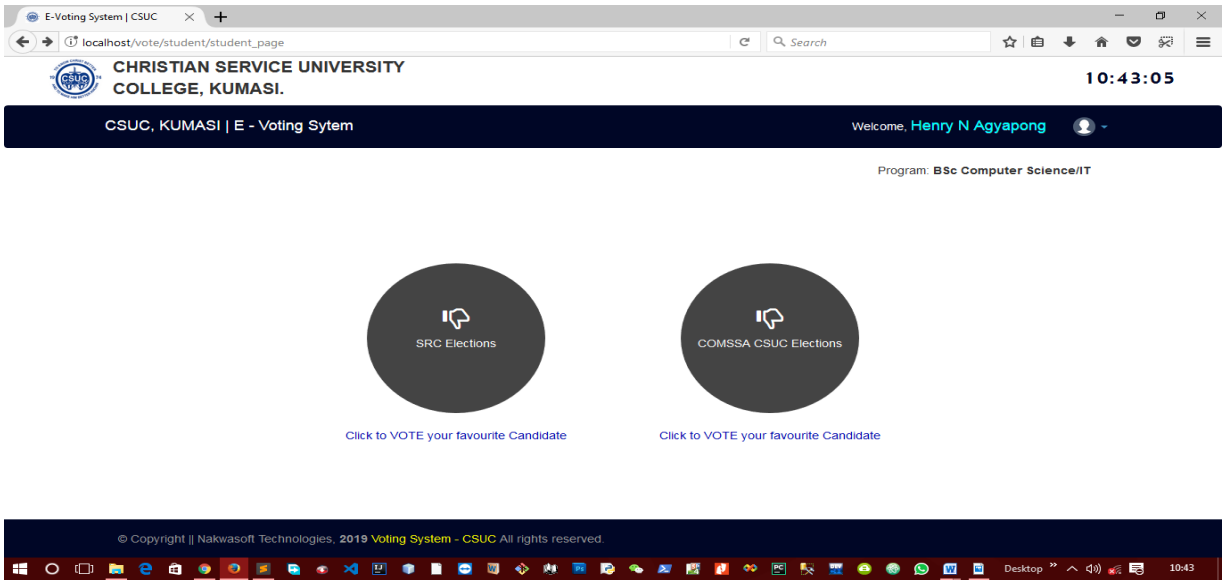


Fig 4.4: *Associations page. This is when two or more associations are conducting elections.*

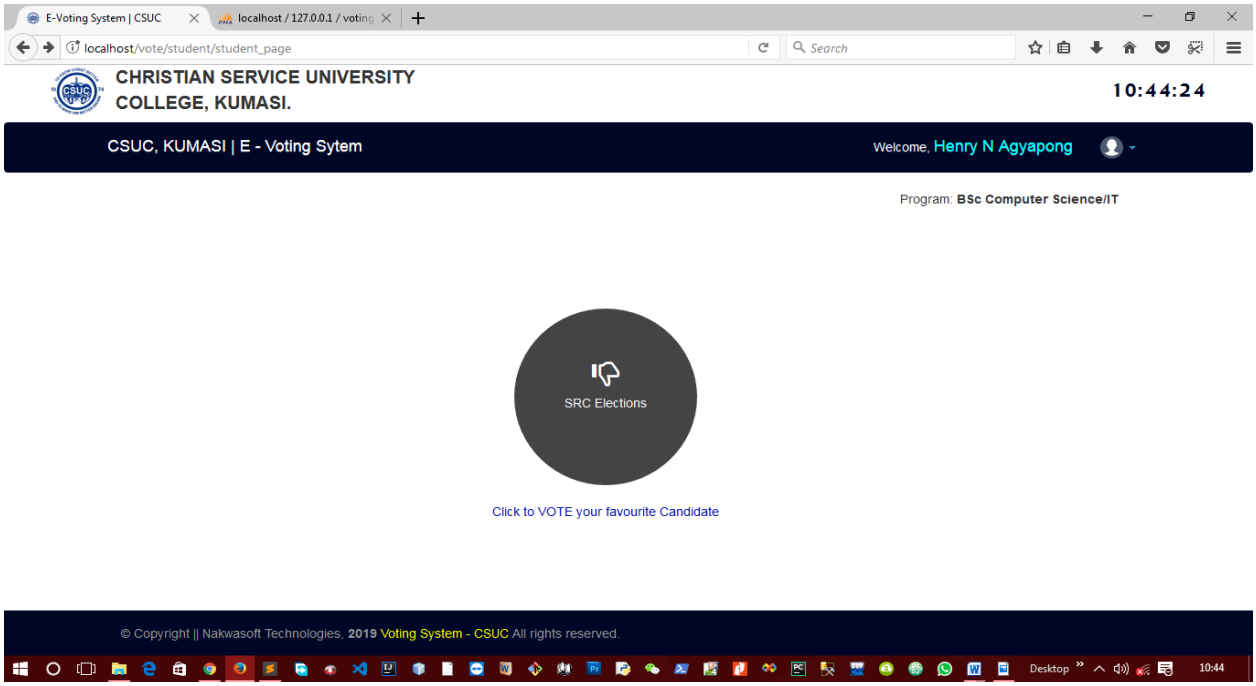


Fig 4.5: One *Associations page. This is when only one association is conducting elections.*

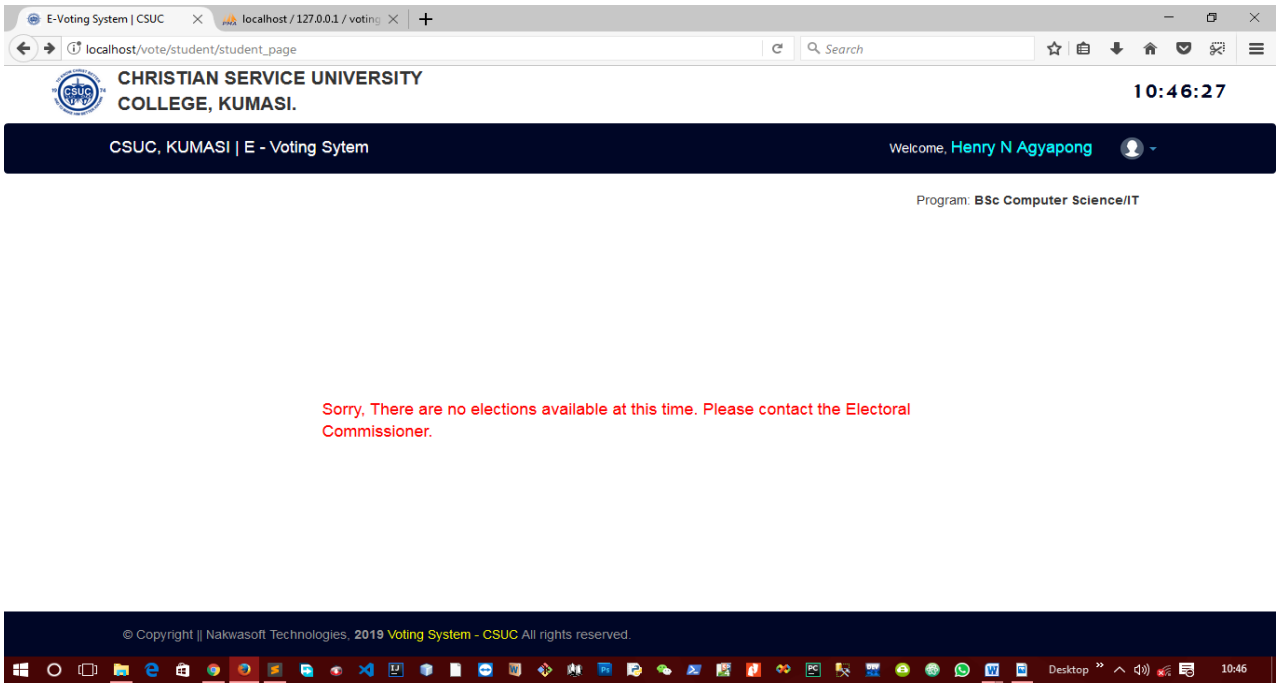


Fig 4.6: No *Election page. This is when no association is conducting elections.*

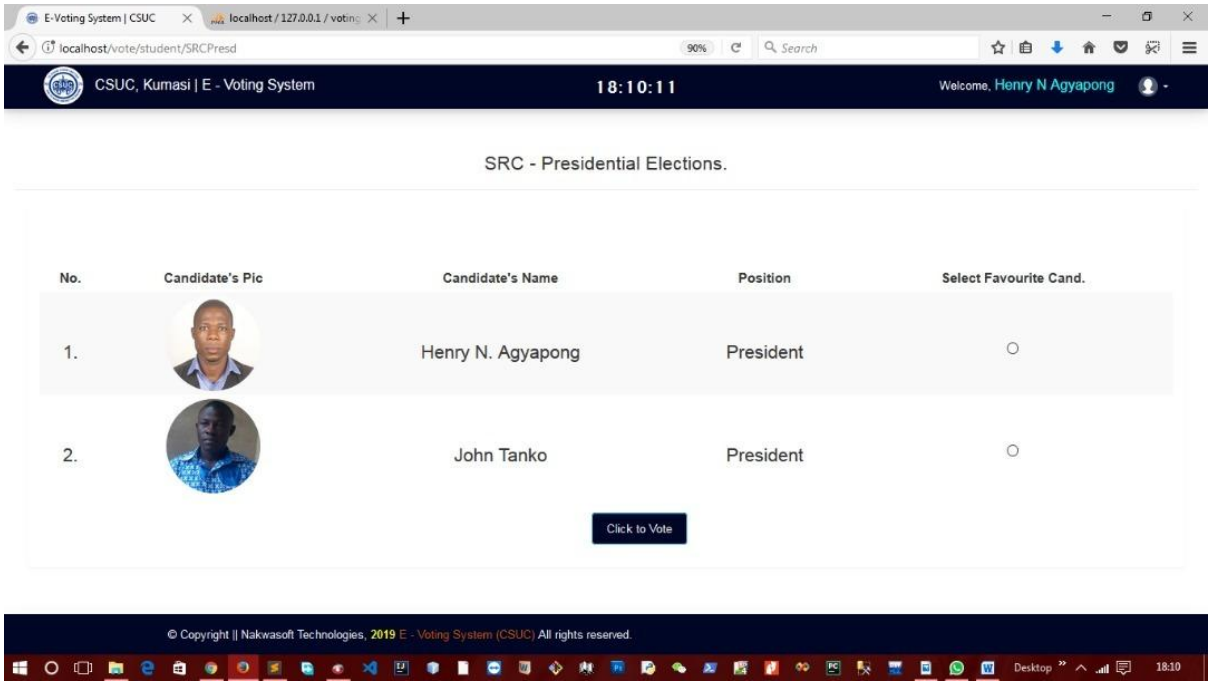


Fig 4.7: *Voting page; where the voter casts his/her votes.*

ELECTORAL COMMISSIONERS USER INTERFACE

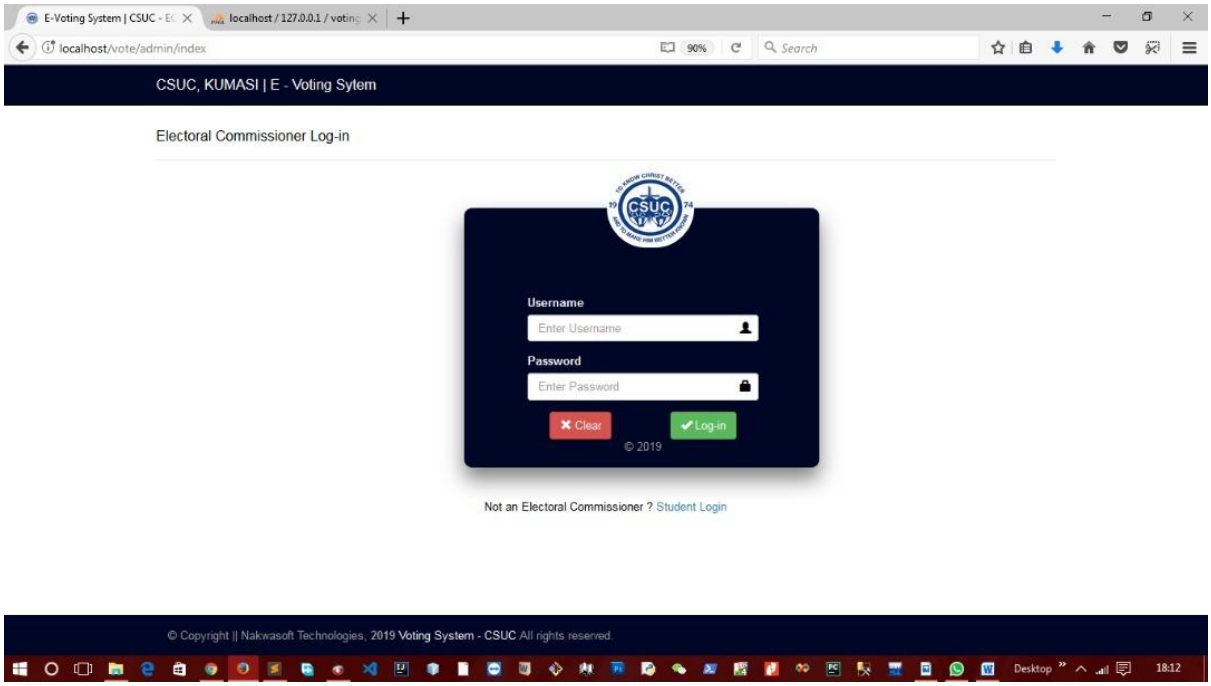


Fig 4.8: *EC login page.*

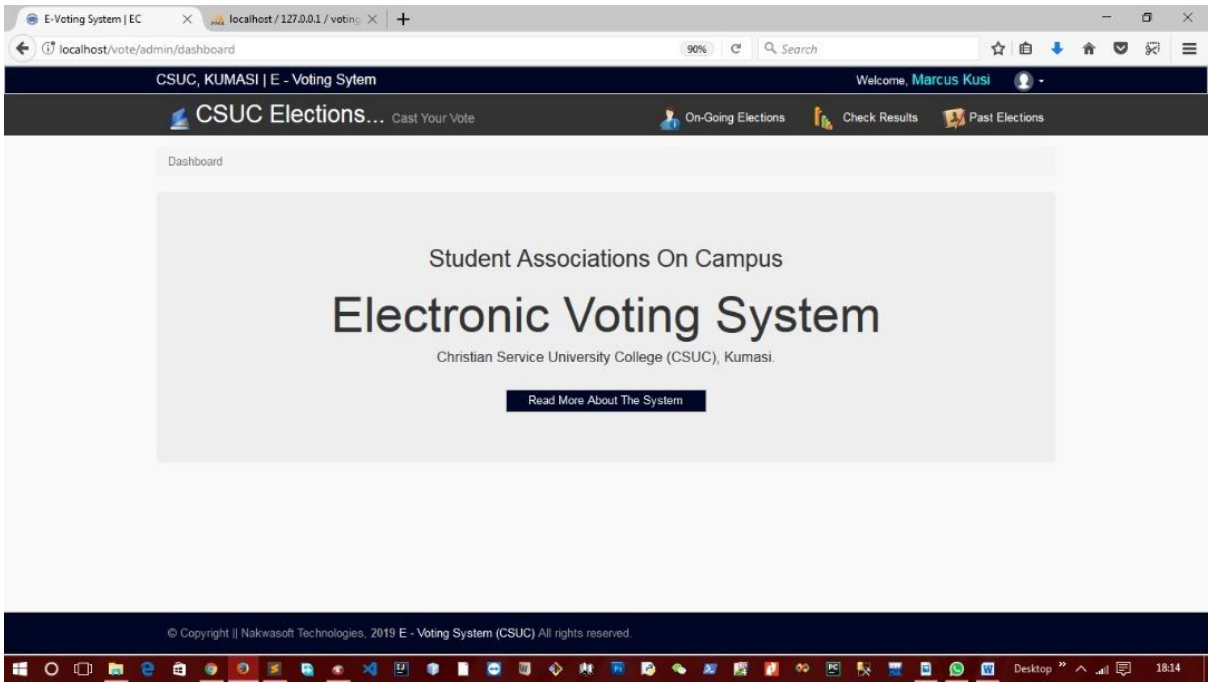


Fig 4.9: *EC dashboard/welcome page.*

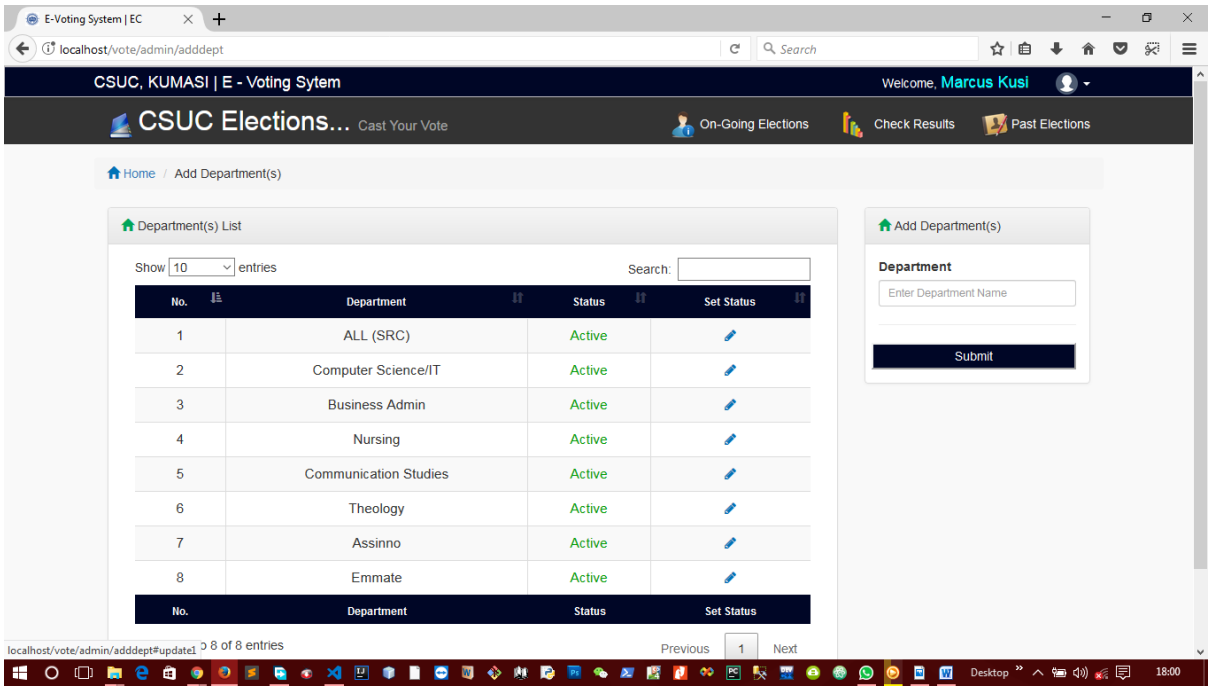


Fig 4.10: *EC department page.*

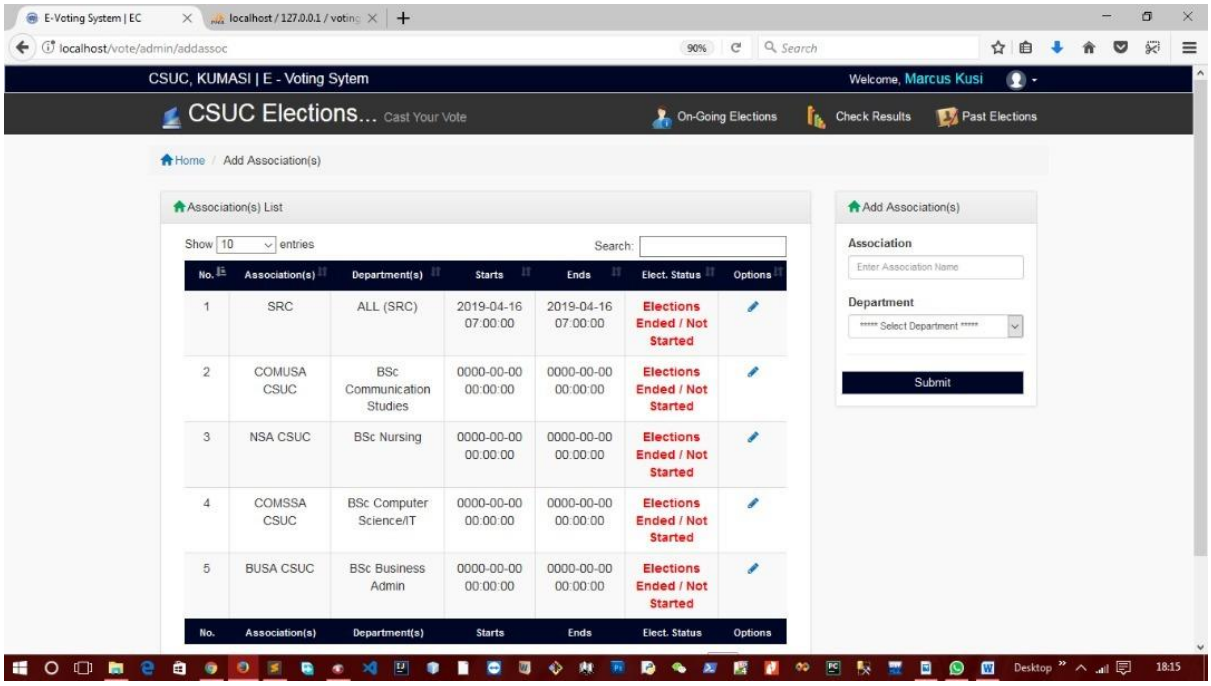


Fig 4.11: *EC Associations page.*

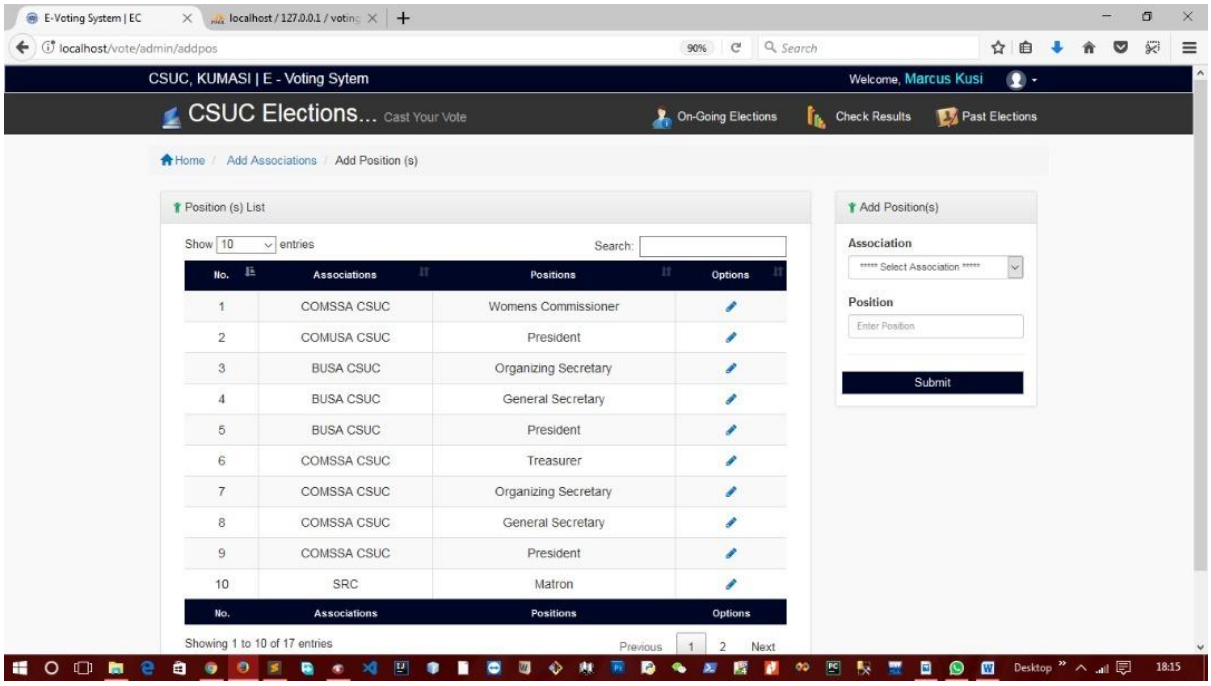


Fig 4.12: *EC Positions page.*

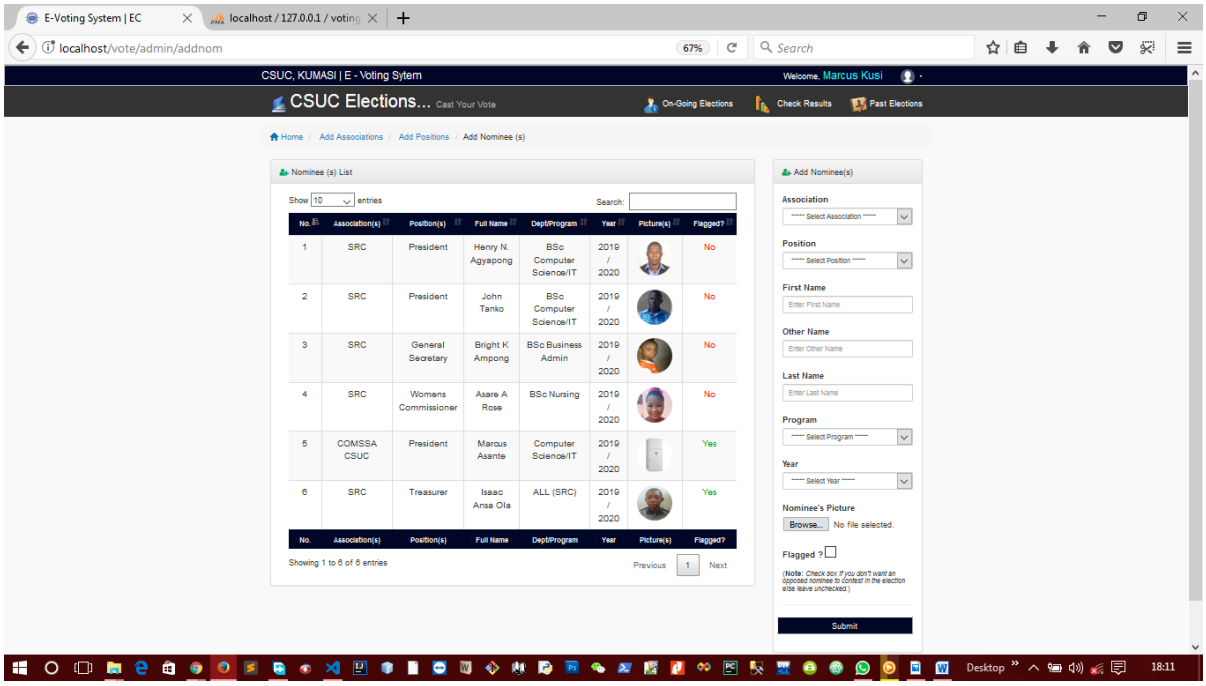


Fig 4.13: *EC nominees' page.*

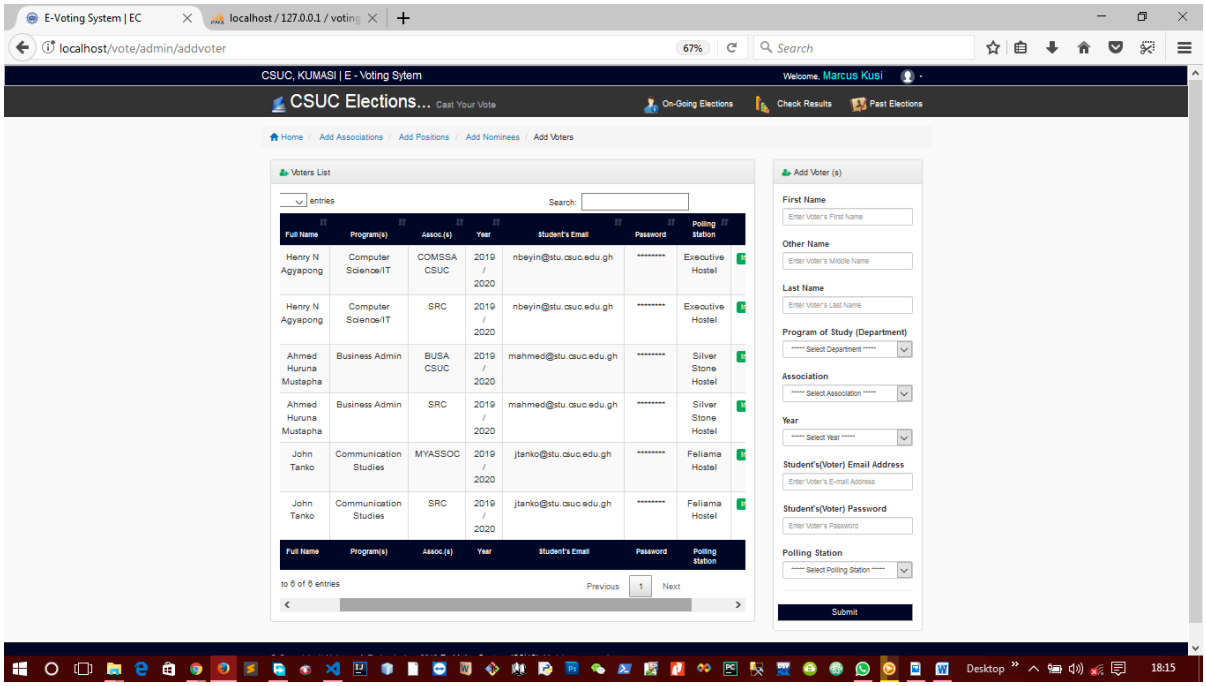


Fig 4.14: *EC voters' page.*

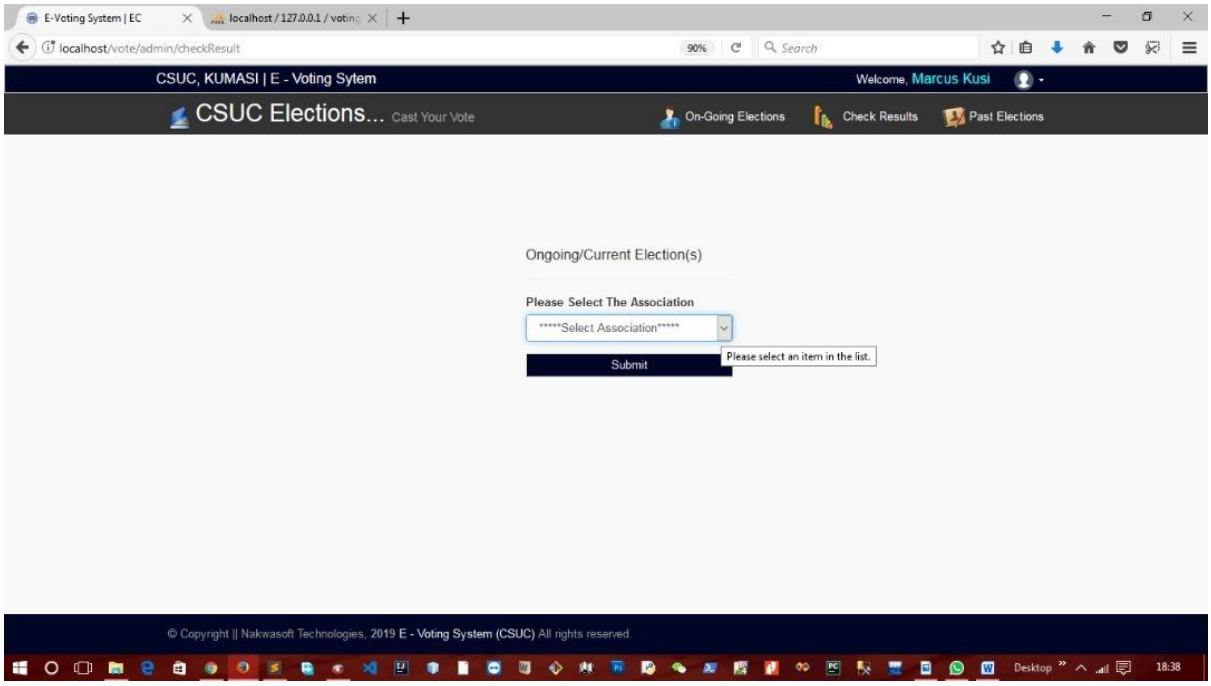


Fig 4.15: *EC check results page.*

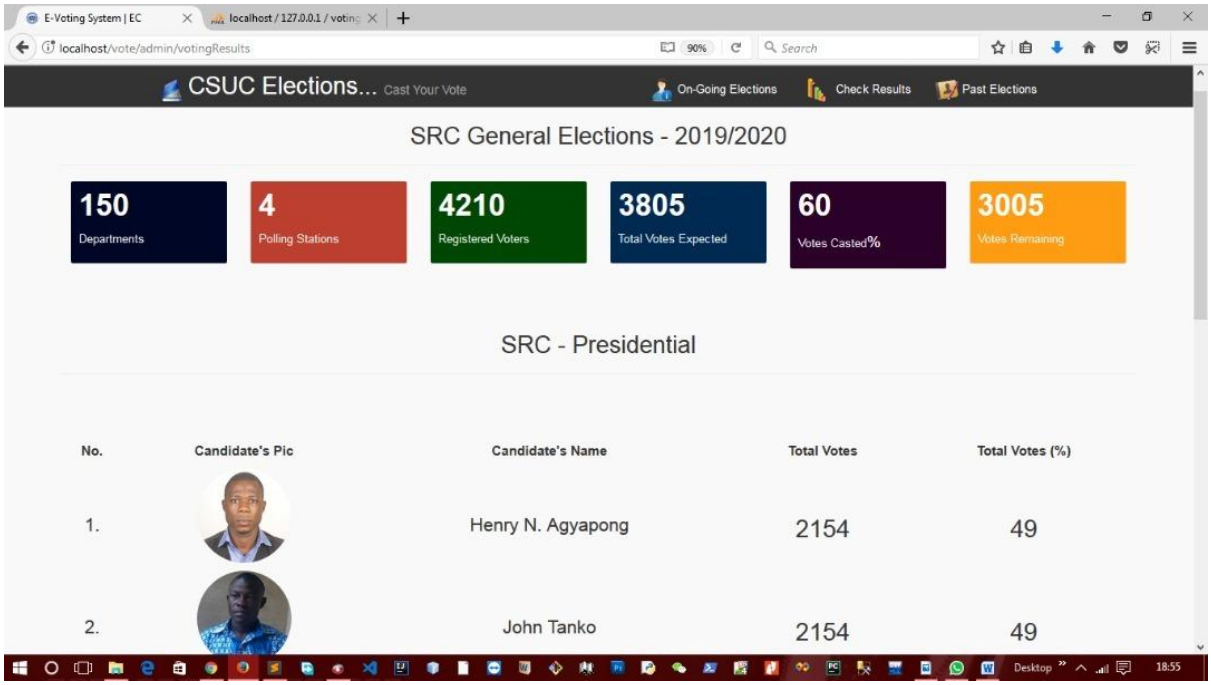


Fig 4.16: *EC results page.*

CONCLUSION

In this chapter, we looked at the results and made some discussions on it. We also looked at how the system functions with respect to the Voter's and Electoral Commissioner's page. We will summarize everything we have done from chapter one to four and make recommendations in chapter five.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATION

INTRODUCTION

This chapter presents a summary of the project/system, conclusion, and recommendations for consideration in the future.

SUMMARY

The system is made up of front and back end. It is designed to run on a local area network. The backend (database) will be seated on a server separate from the frontend (user interface) for data security and sharing. The system backend and frontend is developed using PHP, JavaScript, HTML, AJAX, CSS, and MYSQL respectively.

The development of the system went through a process known as System Development Life Cycle SDLC, to ensure that the objective set out regarding the project was achieved and the end-users satisfied.

Security of the system was high on the agenda and so several technologies such as data encryption; blockchain was introduced to make the system robust against both internal and external attacks.

CONCLUSION

In conclusion despite the challenges we faced, the development of the system was successful. The objective as set out was achieved, though not to the point of completion.

RECOMMENDATION

The time frame for the project was inadequate considering other academic workload and we recommend that enough time for projects in the future will be given.

We recommend the E-voting system to be used for voting because it is accessible, cost-effective, transparent, and it guarantees authority and confidence to voters.

FUTURE PROJECTIONS

There were a lot of features we needed to add in the project; nevertheless, due to time-constrained, we couldn't add them. In the near future we seek to add the following features to the software:

1) Iris detection:

One of the most secure and effective ways of checking authentication to a system is through iris detection which is a form of biometric identification that uses the irises of an individual's eyes. The iris of every individual is unique and can be seen from some distance.

2) Fingerprint detection:

Similar to that of the iris detection is fingerprint detection. As the iris captures the bio of an individual's eye, the fingerprint detection captures the uniqueness of an individual's finger. This will reduce the tendency for one to be impersonated during the election.

3) Blockchain technology:

It is basically a chain of decentralized, distributed inter-connected blocks similar to a ledger used for recording transactions across many computers. Any record in any of these blocks cannot be altered retroactively unless the alterations of all subsequent blocks are done.

4) To host it on the internet to make it available to all voters irrespective of their various locations.
5) Use a more secure PHP framework called Laravel.

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