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E-Voting System for National Association of Computer Science Students Modibboadama University of Technology Yola, Adamawa State, Nigeria

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***Abstract* – This research is on e-voting system for National Association of Computer Science Students ModibboAdama University of Technology, Yola, Adamawa State, Nigeria. The main objective is to highlight the advantages of e-voting system over the manual approach of voting in National Association of Computer Science Student (NACOSS), MAUTECH, YOLA. Interview method and Focus Group Discussion was used for qualitative data collection, RAD system analysis and design was applied for the implementation of the proposed system. From the result of the focus group discussion and the interview conducted, which emphasized the disadvantages of the manual approach of voting in the department for years, the response from the interview made us suggest that an e-voting system for the department will be better suited for the departmental elections if implemented.**

Keywords: e-Voting, HTML, PHP/MySQL, JavaScript, CSS, VVPAT.

I. INTRODUCTION

E-voting refers to an election or referendum that involves the use of electronic means in at least the casting of the vote. The introduction of e-voting raises some of the same challenges as are faced when applying electronics to any other subject, for example e-government. Politicians or administrators may perhaps expect that a paper version of a certain service or process can simply be taken and put on the Internet. Unfortunately, the reality is more complex, and nowhere more so than with e-voting. There have been many developments in the application of e-voting since the Council of Europe Recommendation on legal, operational and technical standards for e-voting (Rec (2004)11) was adopted by the Committee of Ministers in 2004. Some countries no longer use e-voting; some have conducted e-voting schemes and decided not to introduce it. At the same time, there are other countries which are continuing to conduct e-voting. It has been used in other elections, for example student councils or youth councils. There are also countries or organizations which would like to launch e-voting schemes but have not yet examined all the options. This document has been written with them in mind. This document reflects the findings from several meetings at which the development of e-voting has been examined. These include the second review meeting on Recommendation Rec (2004)11 which took place in Madrid in 2008, and the sessions of the Forum for the Future of Democracy in 2008 and 2009. This paper does not set out to argue either for or against the introduction of e-voting; it is designed to provide assistance and guidance to those who are considering introducing it.

Contrary to the traditional way of voting, electronic voting is essential because it considers ways in which the polling tasks can be performed electronically without sacrificing voter privacy or introducing opportunities for fraud, in order to determine whether a system performs these tasks well, it is useful to develop a set of criteria for evaluating system performance. The criteria to be developed are such as accuracy, democracy, convenience, flexibility, privacy, verifiability and mobility (Nurmi, et al,1991). Voting entails a democratic apparatus used to enthrone democratic leaders and in some quarters it is regarded as one of the most effective methods for individuals to express their opinions on a given topic (Chaum, 1981).

Hence, the sort for the best means of voting has also been an issue in the heart of every democratic society.

NACOSS MAUTECH-Yola right from its inception, yearly conducts election for new leaders to emerge.

The National Association of Computer Science Students MAUTECH-Yola still operates the traditional/manual voting system which is faced with the following problems:

1. Delay in Distribution of voting materials
2. Delay in casting and counting of votes
3. Vote rigging
4. Voting crisis
5. Inability or difficulty to analyse votes if the need arise.

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These definitely draws attention to the need for a more convenient, secured and reliable voting system.

Electronic voting system has the potential of highly minimizing human errors, fraudulent acts such as rigging of result and double voting by voters. It will provide a convenient and faster voting system. E-Voting is also an excellent mechanism that does not require geographical proximity of the Voters. For example, students on industrial training can participate in elections by voting online.

The study will serve as enlightenment to democratic bodies to the possibility of an electronic voting system providing security and reliability.

The term electronic voting refers to an election or referendum that involves the use of electronic means in at least casting of the vote (council of Europe 2010). According to Chaum (1981), voting entails a democratic apparatus used to enthrone democratic leaders and in some quarters it is regarded as one of the most effective methods for individuals to express their opinions on a given topic.

Hence Gritzalis (2002) expressed that voting is a process at the heart of a democratic society. He therefore stressed that in recent elections using voting machines have shown that the winning margins could be less than the error margins of the voting systems themselves making election an error prone task. Hence the use of electronic voting has the potential of minimizing human errors. In addition to its reliability, computerized voting can handle modalities such as voice assistance for handicap and provide better scalability for large elections.

Furthermore Cal Tech-MIT (2001) studied the challenges posed by e-voting in trying to develop a new solution that represent the real-world. He further mentioned that while e-voting has been an active area of research for two decades, efforts to develop the real-world solutions have just begun.

In Nigeria, recently INEC said it was considering e-voting as an option in 2015 general elections and that it had started making moves to prevail on the National Assembly to amend the clause in electoral law that prohibits the use of e-voting, several arguments popped up, some political parties have expressed doubts about the feasibility of using electronic voting system during the general elections 2015. Officials of the parties who spoke mentioned that though e-voting had been proven to be effective in some other countries; it might not work in Nigeria.

In the same vein, the national publicity secretary of the All Nigeria Peoples Party, Emmanuel Eneukwu argued that with a large percentage of Nigerians population being illiterate, it was irrational for the INEC to consider introducing e-voting.

However, the national chairman of the Labour Party, Dan Nwanyawu said that since e-voting worked in India, with over 600 million voters, it could work in Nigeria. He added that e-voting is actually the solution to all electoral frauds. He said when there are no ballot boxes to carry, political thugs will go out of business. It is cheaper and more effective he said (The Punch, 2012).

There have been many developments in the application of electronic voting since the Council of Europe's Recommendation on Legal, operation and technical standards for e-voting (Rec (2004)") was adopted by the committee of ministers in 2004. Some countries no longer use e-voting; some have conducted pilot e-voting schemes and decided not to introduce it. At the same time there are other countries which are continuing to conduct pilot schemes and introduce e-voting (Council of Europe, 2010).

Cetinkaya and Centikaya (2007) outlined the necessary components for a computerized voting system, which he said should include but not limited to right of voters, eligibility of voters as defined by the authorities, and the tallying which involves the counting of votes. He further emphasized on four important phases like registration of voters before the election, authentication of eligible voters before being allowed to vote, the casting of vote and tallying of votes.

a) E-Voting Process

A general e-voting process and the actors involved can be summarized as in Fig. 1.

Sampigethaya (2006) looks at the numerous e-voting protocols proposed which are meant to fulfill different requirement sets using cryptographic tools and primitives, these underlying primitives are mainly blind signatures and holomorphic encryption.

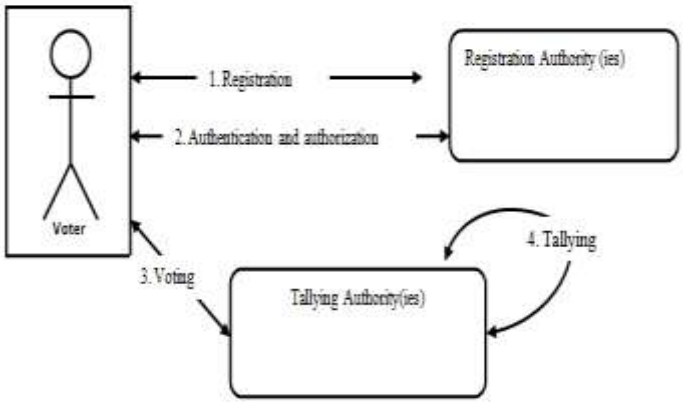

Figure-1: A general e-voting process (Centinkaya 2007, Cranoir 1997, Fujioka1992)

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b) E-Voting Requirements

Fujioka et al (1992) looked into verifiability in terms of the e-voting protocols by forcing voters to involve more than one round. In his approach, a voter has to participate in the counting stage by checking that his vote is listed correctly in the tallying list, and then sending a part of the vote. He therefore defines verifiability as a case where no one can falsify the result of voting.

Later, Sako et al (1995) introduced the concept of universal verifiability to emphasize the importance of auditing of overall election by categorizing the verifiability. In their approach, a sender can verify whether or not his message has reached its destination, but cannot determine if this is true for the other voters and also in the course of the protocol the participants broadcast information that allows any voter or interested third party to at a later time verify that the election was performed properly or not.

Cranoir et al (1997) makes the definition of universal verifiability narrow by limiting it as just counting the votes therefore, their definition of verifiability is to independently verify that all votes have been counted correctly.

Karlof et al (2005) took a different approach from the other researchers as they do not distinguish universal or individual verifiability. So their definition states that verifiability means each voter should be able to verify his ballot accurately represents the vote he cast verifiably counted-as-cast means everyone should be able to verify that the final tally is an accurate count of the ballot.

Therefore it can be seen from the definitions arrived at by the different researchers that individual verifiability and universal verifiability basically are centered on the fact that every voter can check if his vote has been properly counted and anyone can check that the calculated result is correct and election is performed correctly.

On the other hand, Delaune et al (2006) formalizes some of the e-voting requirements and then verifies whether the requirements hold particular e-voting protocols. Specifically, they use the formalism of the applied p-calculus which is a formal language similar to the p- calculus but with useful extension for modeling cryptographic protocols and has been used to analyze a variety of security protocols on other domains. Verification of the requirements is illustrated on two ease studies and has been partially automated using the proverif tool. They brought the formal verification on some of the e-voting requirements. However, this also in keeping with Cansell et al (2007) which recommends application of formal methods for guaranteeing tamper evident storage of votes.

Another well-known study is the concept of Voter Verified Paper Audit Trail (VVPAT), introduced by Mercuri (2000a). According to Mercuri, VVPAT refers to a kind of "vote receipt" printed by an electronic voting machine. The VVPAT is kept by the election official, as the record votes cast. For audit and recount purposes. Therefore Mercuri noted that even though VVPAT is commonly accepted in U.S., it can be easily seen that VVPAT does not guarantee the accuracy of the system. In other words, looking at a piece of paper does not mean verification and voter does not actually verify his vote with VVPAT.

c) Security in E-Voting System

Alexander et al (2004) in his paper discusses what threats e-voting is facing. The purpose ordered overview of attacks against e-voting and to show one solution to the issues. The challenge is to provide identification and anonymity at the same time and to exclude the possibility of fraudulent manipulations by the server administration, the voter, and any third party.

Aviel (2002) discusses the security considerations for remote electronic voting in public elections in particular, he examined the feasibility of running national federal election over the internet. The focus of his paper is on the limitations of the current deployed infrastructure in terms of the security of the host and internet itself. He finally concluded that at present, the infrastructure is inadequate for remote internet voting.

Kohno et al (2004) discusses on the criticism in the Direct-Recording Electronic (DRE) voting system in which they pointed out that due to various deficiencies and security vulnerabilities it has been widely criticized therefore their belief is that the software undergoes insufficient security during qualification and certification; that DREs forms of insider programmer attacks and that DREs have no voter-verified audit trails paper or otherwise that could largely circumvent these problems. All of these criticisms of DREs apply directly to SERVE as well.

d) Scope of the Study

This study focuses on developing an online electronic voting system for NACOSS MAUTECH-Yola.

e) Research Objective

The main objective of this research is to develop an on-line voting system that will highlight the advantages of Electronic system over the manual approach.

II. METHODOLOGY

The following methods of data collection were adopted:

(a) Interview: The researcher interviewed the students of computer science department ModibboAdama University of Technology, Yola in April, 2014 which include about 160 students who gave relevant

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information to the old system which were very helpful and the questions asked were:

1. Does NACOSS conduct election?
2. How often does NACOSS conduct her election?
3. What form of voting system do you currently use? (Manual/automated)
4. What are the processes involved during election?
5. What are the problems encountered in the manual voting process?
6. What is the cost of conducting a whole election?
7. Do you believe that software can handle these problems?

The following were put into consideration during the interview

- Identify whom to be interviewed
- Make appointment with them
- Prepare the questions
- Conduct the interview

The advantages behind this method are: An opportunity to gather a great deal of data, since it is a face-to-face interview with the respondents.

(b) Focus Group Discussion: The researchers being part of the institution made careful observation and study of existing system. Also carried out group discussion, going through documents, manuals, reports etc. This enables the researcher to make some deductions which were used in the research.

(c) Facts Gathering

The facts below are obtained through interviews, observation of the current system and research from books and internet.

Description of the Existing System

NACOSS conducts her election annually. Currently she is running the traditional/manual voting system of election where ballot papers are being printed. On the voting day, members come to queue in order to cast their vote, after which it is being collected and manually counted, and the result announced.

NACOSS Membership: This constitutes all registered students in the department from 100 to 500 levels at the year/session of election.

The Various Positions

- President
- Vice President
- General Secretary
- Assistant Secretary General
- Financial Secretary
- Treasurer
- Public Relation Officer (PRO)
- Social Director

Eligibility of contestants: There are three major criteria for eligibility of contestants:

1. A Contestant must be a member of NACOSS MAUTECH- Yola
2. A Contestant must not be a 400 or 500 level student
3. Contestants must have a minimum of 2.5 CGPA

Registration: Contestants are to purchase forms for registration from the electoral committee (ELCOM) in the department. Registration fees depend on the position and session.

Setbacks of the Current System

- Time consuming
- Prone to error in processing or counting
- Prone to fraudulent acts
- Analysis of votes is difficult if not impossible
- Difficulty in record keeping and analysis

Feasibility Report

From the information gathered on the existing system, it is obvious that it is time consuming, prone to fraudulent acts and errors in data processing. Members on Industrial Training cannot vote due to proximity. Recording and analysis of votes is difficult or not possible. Hence, the need for an electronic voting system. A new, e-voting system is possible and necessary, saving time and reducing errors and fraudulent acts as vote counts and record keeping will be automated. The cost of election/voting materials is reduced. Although the initial cost of developing the electronic voting system would be high, the long run effect would be that election costs would drastically reduce.

(d) Rapid Application Development (RAD).

RAD is a software development methodology that focuses on building applications in a very short amount of time; traditionally with compromises in usability, features and, or execution speed. RAD is an iterative approach which consists of four steps; requirements planning, user design, construction, and implementation.

The structure of the RAD lifecycle is thus designed to ensure that developers build the systems that the users really need. This lifecycle, through the following four Stages, includes all of the activities and tasks required to scope and define business requirements and design, develop, and implement the application system that supports those requirements.

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Planning Requirement

- Microsoft Internet Explorer:
  As a web browser to launch the prototype.
- Macromedia Dreamweaver:
  A tool to design interface which can be linked with the programming language.
- PHP programming language:
  PHP stands for Hypertext pre-processor, is a serve-side scripting language for creating dynamic sites originated in 1994.
- MySQL Database:
  MySQL is an open source relational database management system that uses structured Query Language. It's fast, reliable and flexible. PHP and MySQL work extremely well together (Ullman, 2003).
- WAMP Server
  It serves as the server hosting the site.

Tools for System Analysis and Design

For the analysis and the design of the new system, Object Oriented Analysis and Design tools were used. Some of such tools include:

- The Use case diagram
- The class diagram
- The Entity relation diagram

III. SYSTEM WORKFLOW

Below is architectural representation of the e-voting system.

a) Use Case Diagram

The use case diagram describes the interactions between the users and the software from an external point of view.

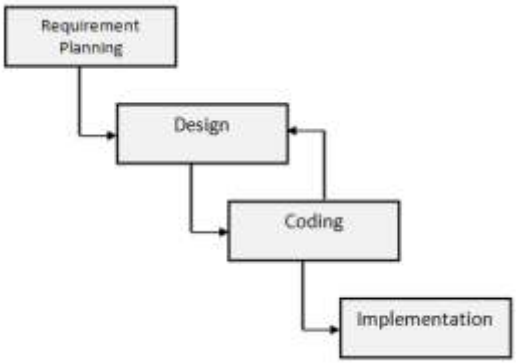

Figure-2: Rapid Application Development

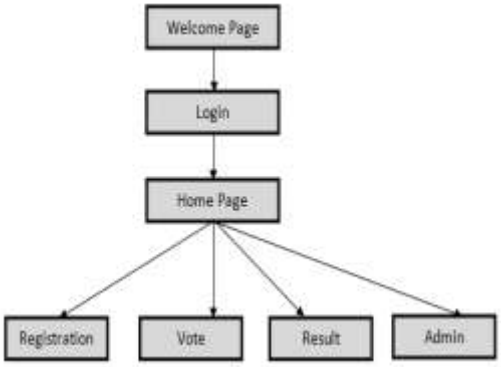

Figure-3: System Workflow

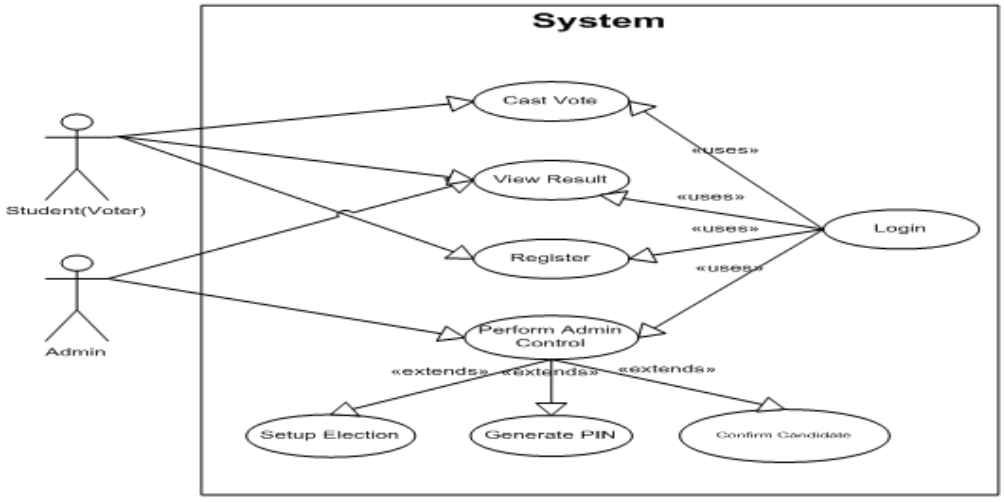

Figure-4: Use Case Diagram for E-Voting

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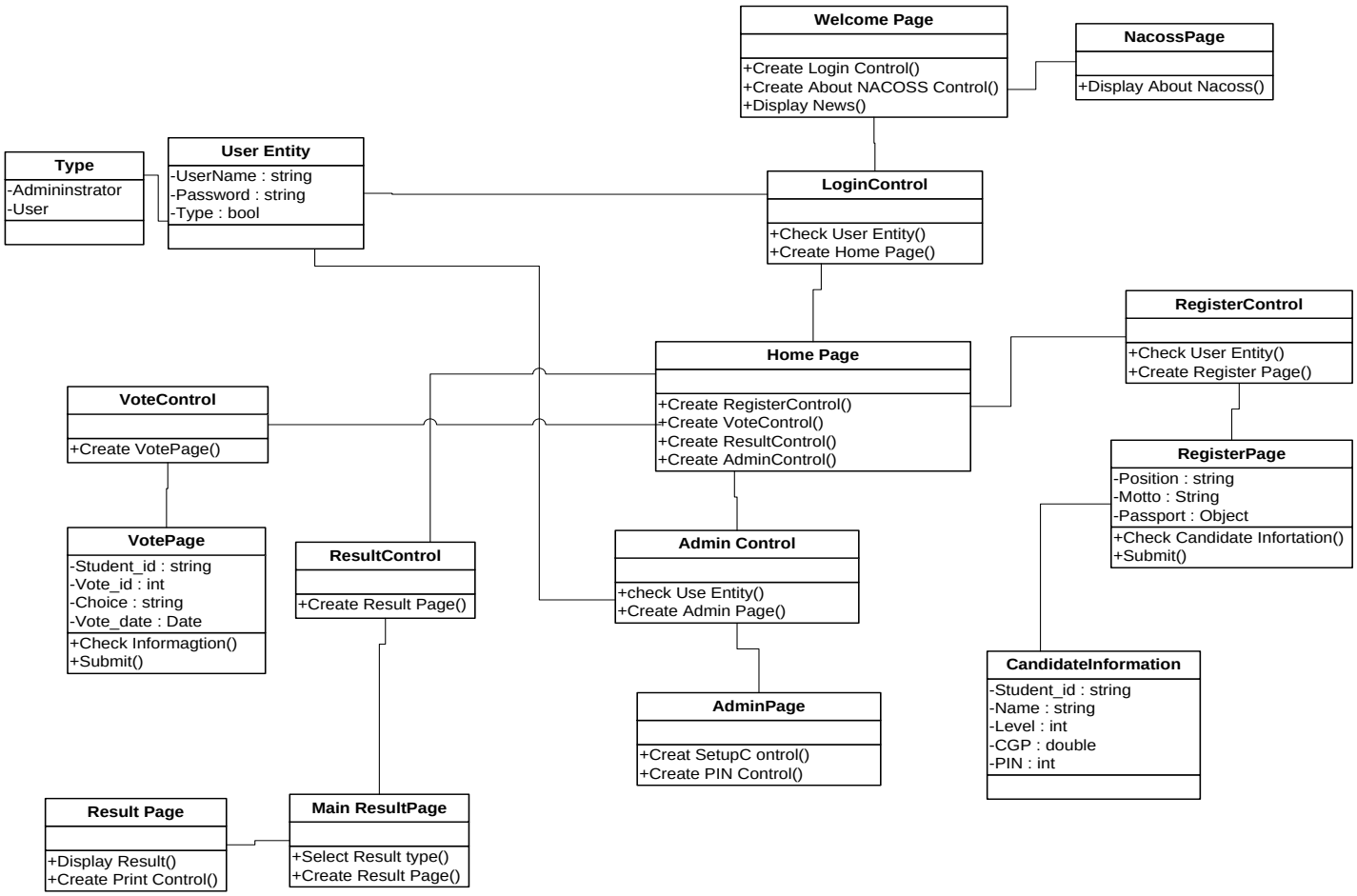

Figure-5: Class Diagram for E-Voting

b) Class diagram

The Class Diagram below describes the various classes in the software and the methods/operations in each class with the associated attributes.

c) User Authentication (Welcome Page)

As seen in the Fig. 6, is the first page to be seen while visiting the system. Every visitor can view this page and also navigate between "About Us", "Leaders" and "Election". Members of NACOSS are expected to supply a valid **"Username"** and "**Password"** then press login button for the system to open for other functions (i.e. registration, voting, result check and admin. Control).

d) Registration Process

To register as a contestant. One is to click the register button in the Home page, and the registration form appears as seen in the Fig. 7. Enter the details of your information and click submit. On error, the button "Clear" will refresh the form for re-entry. In cases of invalid PIN or one has registered before, an error message will appear.

e) Voting Process

As seen in the Fig. 8, a voter selects the position to vote for, make his/her choice then submit. Then he selects new position until he/she is through with the whole positions. In a case where one has voted for a position and wants to vote again, the system alerts him/her.

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Figure-6: Welcome/Login Page

Figure-7: Registration Page

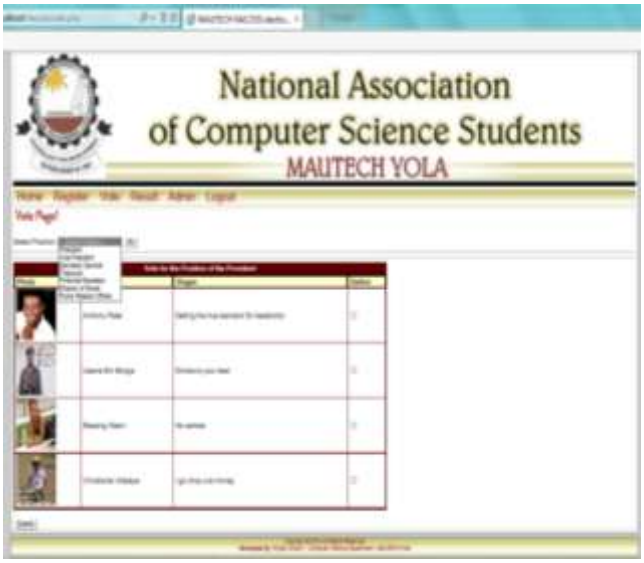

Figure-8: Voting page

IV. CONCLUSION

It is obvious that the application of the automated system developed as computer software for voting is a solution to rigging. It reduces frauds, tricks and so many other crimes related with voting. In the open secret ballot system, there is difficulty in processing, controlling and manually counting thousands or millions of ballot papers by hand, the very best alternative will be the use of an automated voting system.

Because of the advantage of the automated system of voting, many countries and non-governmental organizations have taken measures to conduct a test for its suitability for adoption, research has shown that several countries are now planning to experiment with internet voting. For example in New Zealand a task force has concluded that internet technology would probably boost the number of voters, speed the count and reduce cost of poll sites. Non-governmental organizations have been the first to conduct election using personal computers connected to internet or private networks, in the United Kingdom, the price water coopers elected its governing body via the internet. Apart from United Kingdom many Universities have found computerized voting to be a convenient way for student to elect student government representatives, like the University of Virginia student council election.

Automation of electoral processes is an aspect which cannot be overlooked because of the speed, efficiency, accuracy etc. associated with the electronic process, Nevertheless, more efforts needs to be put in place as regard to the security of the system. Although the initial cost of developing electronic voting systems would be high, the long run effects would be that, election costs would drastically reduce.

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