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Design and Implementation of Electronic Voting System

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Abstract: *The Public opinion and democratic in universities setting are the most important determinant to establish a good administration. Voting is the process through which individuals convey their opinion and has the freedom to elect a leader of the choice to signify and address the student's issues. In today's technological and knowledge age, computerized related matters become widespread. E-voting is one of these substances and it is capable to deliver appropriate, less costly, fast and secure services. The aim of this paper is to present an electronic voting system (E-Voting) to be applied to Muni University student's electoral body. Several security measures were integrated into the E-Voting system in order to achieve an enhanced, speedy and accurate performance. A computer software application was developed using PHP (Hypertext processor) programming language and MYSQL (My Structural Query Language), a relational database management system in designing the database; tested and found to have produced the expected results. It is about time that traditional voting in Muni University gives way to E-Voting and hence simplifies the task for Electoral commission and his/her Officials.*

Keywords: *Muni University, Elections, E-Voting, Security.*

I. INTRODUCTION

Muni University is a Public Campus established by the Uganda Government by Constitutional Instrument, 2013 No.31 [1]. The university is located in Arua district, 3Km South of Arua town in North-Western Uganda. Students at Muni University are required to have free and fair elections for a democratic of the student's union. Elections allow the populace to choose their representatives to express their preferences for how they will be governed. Thus, the integrity and accuracy of the election process are fundamental to the integrity of the democracy itself. Today, many new technological innovations are developing the computerized security and fair exchange including electronic voting which is becoming a popular trend. Our University, Muni, is also trying to keep abreast with the other established Universities in every arena. Therefore, students from Muni start to replace electronic voting instead of traditional paper voting for saving university resources and time. The implementation of secure electronic voting systems is very critical in every student's electoral body. The main goal of e-Voting is to provide voters (students) a good environment so that students can cast their votes with minimum cost and efforts. There are so many properties that have been proposed to make the e-Voting secure process. The properties are: - *Eligibility:* Only eligible/registered students (voters) are permitted to cast and use the system. *Secrecy:* There is no association between student's identification and the system. *Exceptionalness*: No student can cast his/her vote more than once. *Freeness:* A student does not gain any information (a receipt) which can be used to prove to a coercer that she/he voted in a certain way. *Justice:* No incomplete result is obtainable before the concluding result comes out. *Confirmable:* Students can verify that their votes were computed correctly. *Uncoercibility:* No student can prove what he voted for others to prevent bribery. *Effectiveness:* The calculations can be achieved within a realistic amount of period.

II. LITERATURE REVIEW

A. Electronic Voting

Electronic Voting (EV) comprises the use of a computer rather than the traditional use of ballot at polling centers or by postal mail [2]. It involves the method for a group such as a meeting an electorate to make a decision or express an opinion, usually following discussions, debates or election campaigns [3]. It incorporates various types of voting such as kiosks, the Internet, telephones, punch cards, and mark sense or optical scan ballots. India as world's largest democracy with a community of 1.1 billion [4], developed electronic voting machines (EVM). Embraced and supported by voters for elections enable to solve problems associated with the traditional paper-based voting system. The Estonian experience in deploying Internet voting in the United States (U.S) and about 3.4 percent voters were able to use the remote e-voting in 2003 and by 2007 the remote e-voting elections proved secure despite worries about hacker attacks, identity fraud, and vote count manipulation [5].

Regardless of the benefits of E-voting, the variety of its use globally is still, though, partial as it has a shortcoming on many stages such as lawmaking, societal, partisan and technical levels [6], [7] and [8]. The paper underlines the radical and traditional

aspects of Electorate body of Muni student's case for they are the main factors to influence the management's decision concerning the use of the E-Voting system at the university. The operation of the E-voting system raises numerous questions linked directly to votes such as lawful, societal, practical, partisan, managerial and monetary concerns. Though, profiting from the affirmative aspects of E-Voting desires the operation of security measures in order to repair the lack of transparency and to reclaim the trust of constituencies and liable Authorities [6], [8] and [9].

B. The importance of the e-voting system

According to [10] the importance of e-voting are obvious; empowerment; it empowers members to have a voice in the leadership and direction of their organization. When allowed to vote in fair and open elections, members will feel a greater sense of value, ownership, and responsibility. Accessibility; With the surge of mobile devices, online voting is a convenient option for many members, allowing them to access ballots anytime, anywhere. Cost effectiveness; Elections are cost effective, especially when considering production costs of printing, postage, and mailing ballots. Security and confidentiality; A properly designed e-voting system will safeguard in place to assure the security of ballots and protection of voter identities. Transparency; e-elections, particularly those run by a third-party, eliminate the chance of election mismanagement or fraud. An audible trail helps increase voter confidence. Accuracy and expedience; since e-voting utilizes electronic ballots, there are no rejected, mismarked, or invalid votes and results are automatically calculated, eliminating the need for manual tabulation or dreaded recounts. Furthermore, [11] point that e-voting promises an increase in participation and offers voters more options of convenience to vote, encourages more voters to cast their votes remotely, and has great potential to stimulate higher voter turnout. Casting and counting votes are much faster and more accurate with e-voting systems, by default there are no invalid or unclear ballots and the automatic gathering and counting of ballots reduce the amount of time spent counting votes and delivering the results. In addition, [12] pointed that e-voting reduced logistical and administrative costs. The system will reduce the materials required for printing and distribute ballots, the personnel required to assist in voting stations reduces and greater accessibility for the old and disabled people increase and allows to accommodate them as they cast their votes comfortably at their own homes.

III. MATERIALS AND METHODS

A. The System Database and Specifications

MySQL server was used to implement the back-end of the system. The access to the database server was made possible by a graphical interface (phpMyadmin). The database name was given voting.

TABLE I: THE CATEGORICAL TABLE ATTRIBUTES

Field	Type	Null	Key	Default	Length
Cat_id	int	No	PRIMARY	none	20
Cat_name	varchar	No	-	none	20
Start_time	varchar	No	-	none	20
End_time	varchar	No	-	none	20

TABLE II: THE CANDIDATE TABLE ATTRIBUTES

Field	Type	Null	Key	Default	Length
Cand_id	Int	No	PRIMARY	none	20
Fullname	varchar	No	-	none	20
Username	varchar	No	-	none	20
image	varchar	No	-	none	20
Position	varchar	No	-	none	20
About	varchar	No	-	none	20
Voter_id	Text	No	Foreign Key	none	20
Cat_id	int	No	Foreign Key	None	20

TABLE III: THE RESULT TABLE ATTRIBUTES

Field	Type	Null	Key	Default	Length
Result_id	Int	No	PRIMARY	NONE	20
Cat_id	Int	No	Foreign Key	none	20
vote count	Int	No	-	none	20
percentage	double	No	-	none	20
Cand_id	Int	No	Foreign Key	none	20

TABLE IV: THE VOTER TABLE ATTRIBUTES

Field	Type	Null	Key	Default	Length
voter_id	Text	No	PRIMARY	None	20
image	varchar	No	-	None	20
firstname	varchar	No	-	None	20
lastname	varchar	No	-	none	20
Sex	varchar	No	-	None	20
username	varchar	No	-	None	20
password	varchar	No	-	None	20
course	varchar	No	-	none	20
sponsor	varchar	No	-	none	20
Cat_id	Int	No	Foreign	None	20

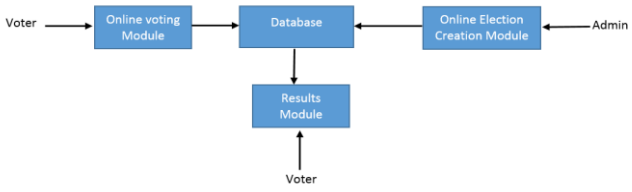
B. The Users' Interaction with the System

The E-Voting system seeks to computerize the voting process through a convivial, efficient and easy-to-use graphical interface. The E-voting system was managed by Dean of student and the electorate body to oversee and observe the election process.

They established the sub-systems and declaring the final results. Every polling center was equipped with a plug-and-play system especially custom designed for the case of this center and it works separately from the main system server. The persons who want to vote need to be registered by the electorate (Chairman electoral commission) to be a voter. The voters must send their personal data including voter name and voter ID to the electorate chairman in order to be checked for validity.

FIGURE I

THE SYSTEM ARCHITECTURE



The system architecture indicated the modules and flow of the system.

C. The Online Voting Module

The online voting module presents the login form for the students to sign in.

FIGURE II

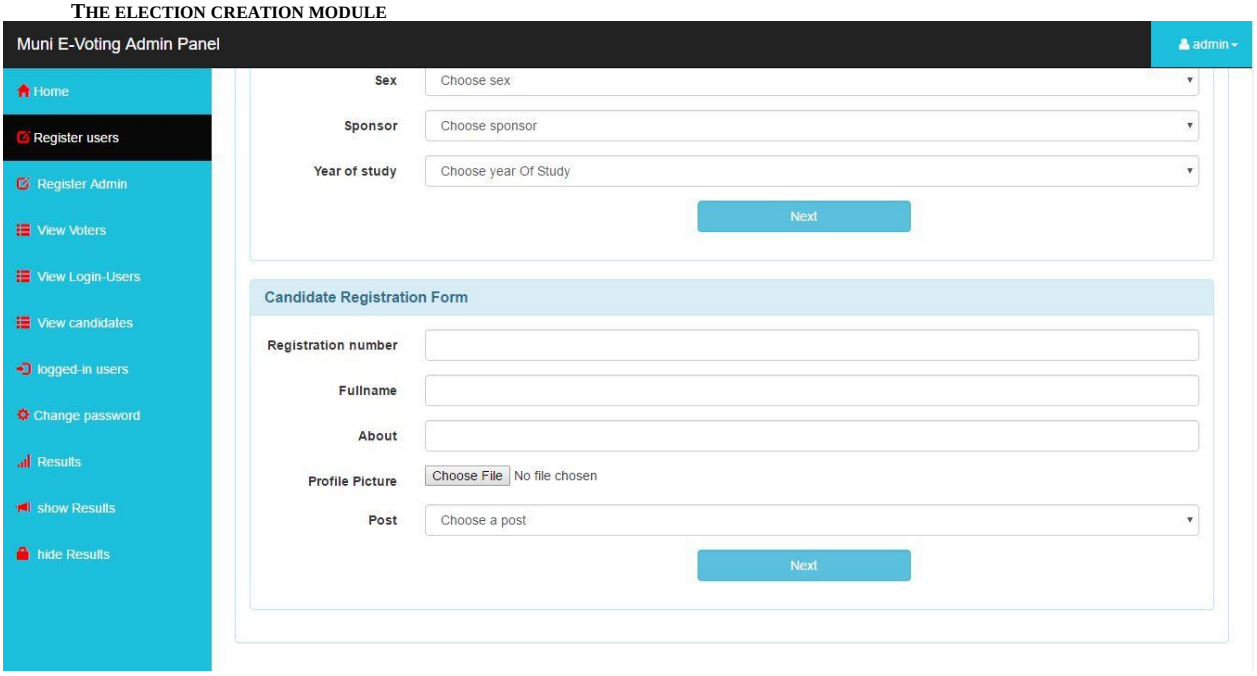
THE LOGIN PAGE

D. The Online Election Creation Module

The online election creation module is where the admin (electorate chair) creates polls, register the posts and the candidate as well as the voter's particulars such as student guild, student religious leaders, student class representative and specify the start and end periods of the voting.

FIGURE III

THE ELECTION CREATION MODULE



Besides the online creation module, there is a voting component that displayed all registered posts and the corresponding candidates on each post. The voter cast the vote on a post he/she wish and the system automatically adds the casted votes into the database and restricts the voter to vote twice.

FIGURE IV

THE ADMIN PANEL FOR AVAILABLE POSTS

posts	voting status	voting time
Giuld president	VOTED	2017-03-25 06:29:04
GRC for Government Sponsored Students	VOTED	2017-03-25 06:30:03
GRC for Private Sponsored Students	NOTVOTED	0000-00-00 00:00:00
GRC for Female Students	VOTED	2017-03-25 06:30:15
GRC for Clubs and Associations	VOTED	2017-03-25 06:30:30
GRC for Games and Sports	VOTED	2017-03-25 06:30:46
GRC for Approved Hostels	VOTED	2017-03-25 06:30:55
GRC for Religious Denominations	VOTED	2017-03-25 06:31:32
GRC for PERSONS WITH DISABILITIES	VOTED	2017-03-25 06:31:42
GRC for OFF CAMPUS STUDENTS	VOTED	2017-03-25 06:32:16

About us

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This page allows voters to select the candidate of their choices.

Select the post on which you want to cast the vote

FIGURE V

USERS LOGIN FOR VOTE CASTING

Muni E-Voting Admin Panel

Search...

admin

- Home
- Register users
- Register Admin
- View Voters
- View Login-Users
- View candidates
- logged-in users
- Change password
- Results
- show Results
- hide Results

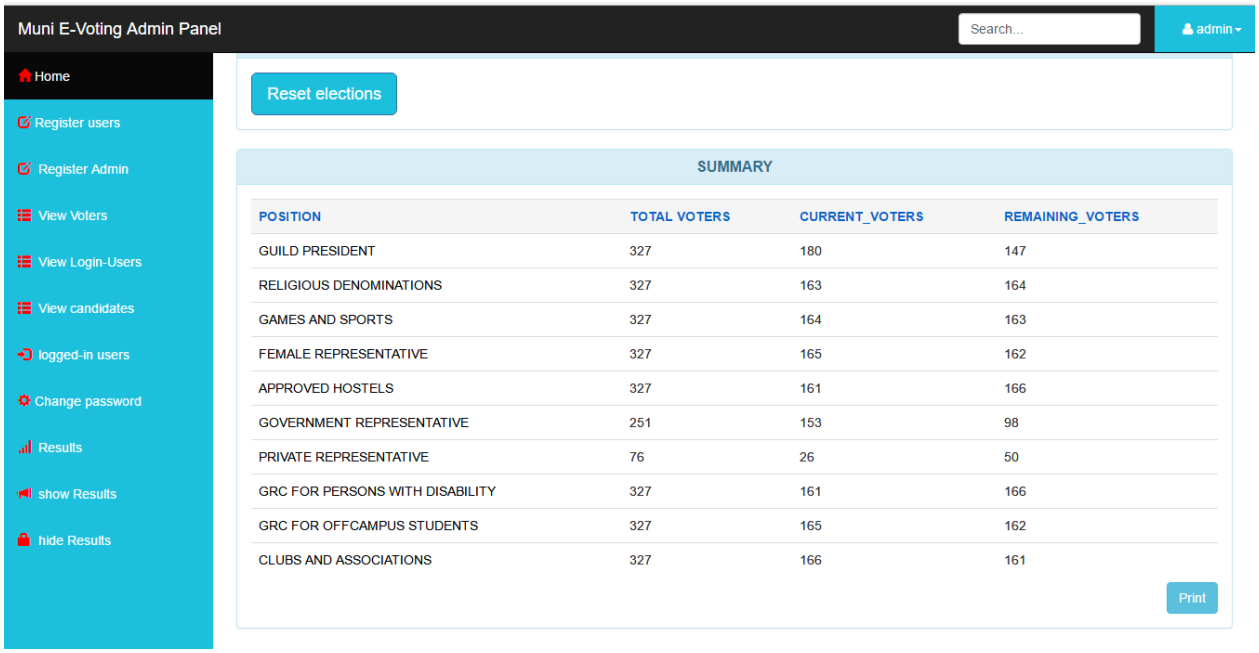
logged-in Users

Reg No	FirstName	LastName	Course	Loggedin	Loggedout
2016/U/ITM/001/G	AHABWE	RAHEAL	ITM	2017-03-25 06:04:28	0000-00-00 00:00:00
2014/U/ITM/005/G	SHARON	ALIRU	ITM	2017-03-25 05:20:15	0000-00-00 00:00:00
2014/U/ITM/004/G	EDEZU	SOLOMON	ITM	2017-03-25 09:07:47	0000-00-00 00:00:00
2016/U/ITM/012/G	OKIRIA	ABRAHAM	ITM	2017-03-25 03:21:09	2017-03-25 03:18:10
2016/U/SMP/005/G	AZUDI	GEORGE	EDUC	2017-03-25 08:14:19	0000-00-00 00:00:00
2016/U/SMP/013/G	MWEBESA	SPLEDOUR	EDUC	2017-03-25 03:28:59	0000-00-00 00:00:00
2016/U/SMP/017/G	RUHANGARIYO	DAMAZO	EDUC	2017-03-25 08:14:52	0000-00-00 00:00:00
2016/U/SMB/005/G	WILSON	DYEYONGERA	EDUC	2017-03-25 03:00:00	0000-00-00 00:00:00
2016/U/SMB/006/G	JOHN BAPTIST	KAGANDA	EDUC	2017-03-25 03:50:55	0000-00-00 00:00:00
2015/U/ITM/057/G	katende	james	ITM	2017-03-25 04:55:43	0000-00-00 00:00:00
E-Voting Administrator				2017-08-13 06:37:39	2017-07-25 19:43:16

The page indicated the users who logged in for the vote cast at a particular time.

FIGUR VI

THE VOTE CASTING PAGE



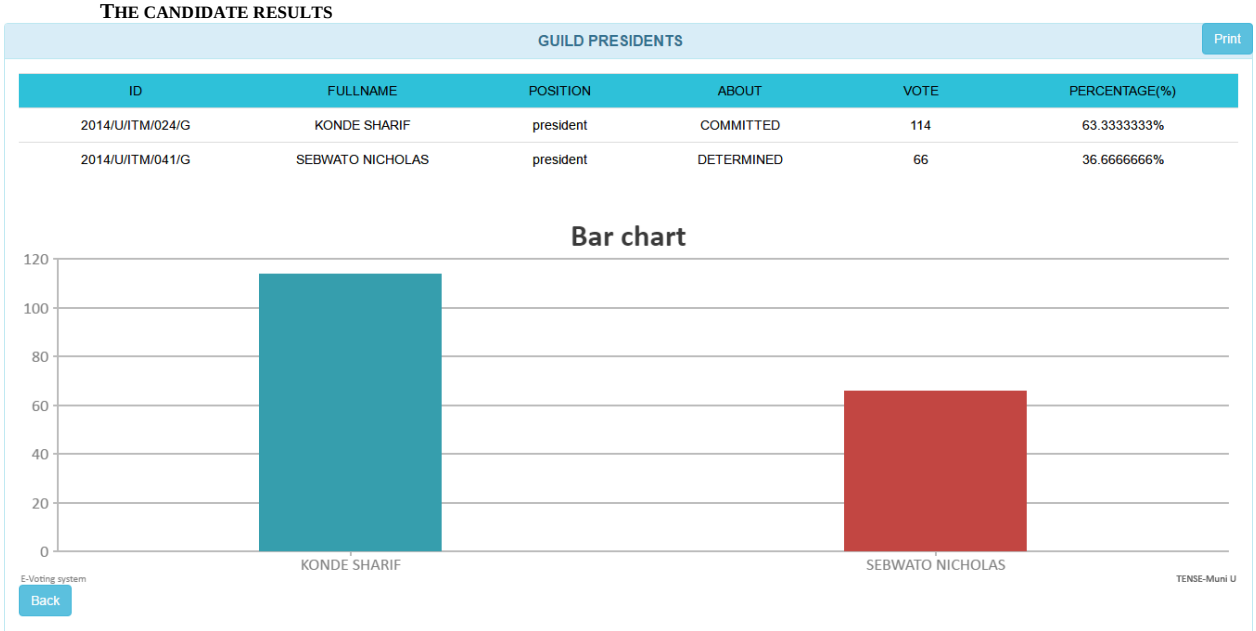
The summary number of voters cast from different posts.

E. The Results Module

The results module provide the voter with summary numbers of the voters who voted and those who did not vote on the particular posts, compute the percentage, generate the graph and finally printed the report.

FIGURE VII

THE CANDIDATE RESULTS



F. Conclusion

This paper described the types of electronic voting systems and essential security properties of electronic voting systems. It aimed to design and implement a real application for an electronic voting system for Muni University. It satisfied the important properties such as receipt-freeness, verifiability, authentication, and integrity, efficient and easy-to-use graphical interface, saves money, time requirement. Furthermore, the integrated

system would avail the electorates the opportunity of casting their votes using the most convenient medium among the e-voting. The adoption of the integrated system increased the level of participation in the institution because of the ease of voting and its tendency to eliminate electoral fraud. We, therefore, recommend that the Muni University should put the E-Voting technology at practice to phase out the traditional voting system. More rudiments to be focused on biometric technology to capture the real identity of the voter and broaden the security requirements of non-repudiation.

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