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PRESIDENTIAL ELECTRONIC VOTING SYSTEM

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Abstract

The focus on the discussion of the security requirements for a reliable electronic voting system and the requirements are implemented in several EVS.The Election that is carried out in democracy is the process that allows a citizen to vote government in power.This is the evolution of voting system which must be strengthened during election process.This implementation of electronic voting system is deferred from a traditional voting system.Electronic voting is very crucial as a tool of the electoral process which is efficient in order to increase trust in its management.E-voting is properly implemented to find solutions of increasing security of the election and make voting to be carried out in easy system.If it is not carefully planned and designed, e-voting can undermine the confidence in the whole electoral process.The presidential election process needs the functional and non-functional requirements.The functional requirements is designed and proposed to well-secured identification and authentication processes for the voter to use the combined simple biometrics.The design of the system guarantees the votes in favor of a given candidate.Due this election system, with the proper incorporation policy, will enhance transparency of voting.The phases of an election process can assure the voter to have his/her choice of candidate to be elected.Besides to that, the main the proposed system is designed to provide several essential non-functional requirements.

Key words: security, cryptography.

1. General introduction

Election is a fundamental instrument of democracy that provides an official mechanism for people to express their points of view to the government.

Traditionally, the process of voting is quite hard because voters must come in personally to vote. These problem outcomes in the low participation rate of voting. Voting by mail can interrupt certain voters who live and work far away from the voting centers.

However, this method is time-consuming management and very difficult for the leader to manage since it asks extra work to mail, collect and count the ballots manually [1]. Electronic voting system or EVS can solve those problems. EVS is expected to modernize social life more convenient, efficient and cheap. By using EVS in national election, a voter can vote while he or she is at his home or office.

EVS must be secured requirements as far as confidentiality, integrity, authentication, and verifiability are concerned. EVS must be secured requirements as far as confidentiality, integrity, authentication, and verifiability are concerned. In fact EVS is more vulnerable than traditional voting due to the nature of digital processing of election data which can fight against corruption and fraud [2].

2. E-voting in Worldwide

Australia

Approximately 300,000 impaired Australians will vote independently for the first time in the 2007 elections. The Australian Electoral Commission has decided to implement voting machines in 29 locations.[4]

In October of 2001 electronic voting was used for the first time in an Australian parliamentary election. In that election, 16,559 voters (8.3% of all votes counted) cast their votes electronically at polling stations in four places.[5] The Victorian State Government introduced electronic voting on a trial basis for the 2006 State election. [6]

Brazil

Electronic voting in Brazil was introduced in 1996, when the first tests were carried in the state of Santa Catarina, Brazil. Since 2000, all Brazilian elections have been fully electronic. By the 2000 and 2002 elections more than 400 thousand electronic voting machines were used nationwide in Brazil and the results were tallied electronically within minutes after the polls closed.
HYPERLINK "http://en.wikipedia.org/wiki/Electronic voting" \l "note-ace%23_note-ace" [5] Joao Abdu Jr. who was with the original Brazilian company and has served as president of Diebold Procom Industrial Electronica since April 2003, has been promoted to vice president of the company's Latin American Division.

Canada

Electronic voting in Canada has been used since at least the 1990s at the municipal level in many cities, and there are increasing efforts in a few areas to introduce it at a provincial level.

In the Canadian Province of Ontario, from November 5 to November 10, 2003, 12 municipalities from the Prescott Russell and Stormont Dundas & Glengarry Counties held the first full municipal and school board electronic elections in North America using either the Internet or the phone but no paper ballots.[5]
Peterborough, HYPERLINK "http://en.wikipedia.org/wiki/Ontario" Ontario used Internet voting in HYPERLINK "http://en.wikipedia.org/wiki/2006" 2006 in addition to the paper ballots.[7]

Estonia

Electronic voting in Estonia began in October 2005 local elections when HYPERLINK "http://en.wikipedia.org/wiki/Estonia" Estonia became the first country to have legally binding general elections using the Internet as a means of casting the vote and was declared a success by the Estonian election officials.
In 2007 Estonia held its and the world's first National Internet election. Voting was available from February 26 to 28.[8] A total of 30,275 citizens used Internet voting.[9]
India
Electronic voting in India was first introduced in 1982 and was used on an experimental basis in the North Parur assembly constituency in the State of Kerala. However the Supreme Court of India struck down this election as against the law in A C Jose v. Sivan Pillai case. Amendments were made to the Representation of Peoples Act to legalise elections using Electronic Voting Machines. In 2003, all state elections and HYPERLINK "http://en.wikipedia.org/wiki/By-elections" by-elections were held using EVMs.[5]

Electronic Voting Machines ("EVM") are being used in Indian general and state elections to implement electronic voting in part from 1999 general election and recently in 2018 state elections held in five states across India. EVMs have replaced paper ballots in the state and general (parliamentary) elections in India.

Security Issues of EVS

EVS is more vulnerable than traditional voting due to the nature of digital processing of election data which can be easily manipulated, hence may result in widespread fraud. Therefore, specific security measures must be included in designing EVS in order to achieve the same level of security as the conventional election. In electronic voting literature, an extensive list of properties and requirements is discussed. Here we summarized the core requirements that are desirable in any election system and it can be categorized into four aspects:

- Confidentiality
- Integrity
- Authentication
- Verifiability

Confidentiality means that data, objects and resources are protected from unauthorized viewing and other access.

Integrity means that data is protected from unauthorized changes to ensure that it is reliable and correct.

Availability means that authorized users have access to the systems and the resources they need

3. Statement of the problem

In Rwanda, traditional method which is used is having different problems like less number of people going for registrations as well as for voting due to the matter of time required to be spent on queue, sometimes corruption can be done easily, errors appearing during counting the votes, and so on. Electronic voting (in parallel with ballot voting) is one of the effective ways to solve many of these problems. But till now there is no such electronic voting system.

4. Current Election and Voting System in Rwanda

An election is a way of making a choice among different candidates; one or many candidates will be elected depending upon to the post provided for a given period of time, this voting is done in the classical (i.e. traditional) way. In Rwanda election takes place for electing the President, Senators, Parliament members, Provincials, Districts, Sectors, Local villages' representatives etc.

Before any election, the Government is informing the type of election which is going to take place, when it is going to take place, and then request the eligible (i.e.=>18 years old) people to register to the different stations, where the people in charge of registration will be waiting for the people to come for registration. The government advertises the date at which registration is starting, the last date of registration, and also the registration centers. The registration process involves writing down the name of the person, his age, father and mother names, marital status, address, etc. This takes place till the last date of registration.

The interested candidates will have to submit their candidatures according to the required criteria, and then the comity in charge will select the ones with the complete conditions and publish them through the News papers, Radio, Televisions and through the website.
The registration phase accordingly ends with sets of tables: tables for the candidates and set for the registered voters.

All allowed candidates will be given equal fixed period of time for campaign, where they will be given the opportunity to present to the population their future plans. Based on the type of election, the required number of candidates will be selected based on the results of the voting. Whenever there is only one candidate required after election, the candidate with the highest percentage will be chosen. For example: An election of the President of the country. But it may happen that the elected candidate didn't get the required percentage of votes, so in this case the first two candidates will have to repeat the election till one wins the vote.

Depending on type of election, the election can be organized to the whole country, to chose only one person among any number of candidates like presidential election, in case of parliament election a number of winners will be chosen depending upon to their percentages and the number of seats provided by the government or it may be organized by provincial areas so that each province can organize its election, or each District and son on.

This traditional election method has some disadvantages starting from the registration phase to the elections. Some of the disadvantages are:

- It takes longtime to end election, to count the votes and to announce the results,
- Errors can occur during counting the votes,
- Easy to cheat,
- It may be easy to know who voted for whom,
- It requires so many people in charge of election in every station election,
- Millions of the forms have to be used in the election, and
- Huge effort and time are required to establish different stations for elections in all over the country.

It may happen that some forms of the voters are missing during election, and then in this case the people missing the forms have to complain to the concerned station offices where they can decide what to do after verifying the complains.

5. E-VOTING (ELECTRONIC VOTING)

5.1. E-voting definition

E-voting is an election system that allows a voter to record his of her secure and secret ballot electronically. Electronic votes are stored digitally in a storage medium such as a tape cartridge, diskette, or smart card before being sent to a centralized location where tabulation programs compiled and tabulate results. [11]

In order to solve those problems cited above in traditional method, E-voting System will be used to make an innovation to that existing system. Our aim is to create a new system which will facilitate for the people the way of registering and making votes by using the machines, so that everything related to vote will be done in their own places (i.e. in their houses), and there will not be a long queues of people in front of the registration or voting centers.

Because of the long waiting in the queues of the registration and voting, many people are not participating in the election process. Some countries put fines on the eligible voters who did not participate in election. Using E-voting will solve this problem; registration and voting take place electronically using the personal computer or the cell phone of the voter at any convenient time during the given periods of registration and voting. This result in more participation in the election process compared to the traditional method. Another facility is that any body can cast a vote from any where in the country, which is not possible for traditional election method, where the person has to make vote from where his has done a registration. In all voting techniques, we use electronic voting equipment: Like Internet voting (I-VOTING), Remote Electronic Voting (REV), Online voting, Kiosk voting etc.
It is possible to recognize two phases in E-voting:

- Pre-election and
- During election.

5.2. Pre-election phase

It is important to note that electronic voting is not replacing the traditional ballot voting, rather it represents a part from the voting process that facilitates and encourage certain class of voters to take part in the election process. Accordingly, it is during the registration phase the electronic registration will be a facility besides the normal paper registration that takes place at the registration centers.

To facilitate the electronic registration, the government will provide a special website where all information regarding registration as well as election is provided. A person is logging in and fulfills the registration form provided on the website. This form contains, normally, all the identifications of a voter e.g. name, date of birth, father's and mother's name, address, marital status, ID number, etc.

In this stage the voter has to define exactly the way he is going to choose for voting, i.e. electronically (e-voting) or ballot voting. Here we separated between electronic registration and electronic voting; it is not necessarily that each one registered electronically will use e-voting during the Election Day. For this reason the person the voter has to express his intention for using e-voting. The system in this case will take an action towards either generating the cryptographic material required during the e-voting or in case of using smart identity card (see latter) the system will ask for a password to be used latter and issues voting ID (IDV). In all cases, we are assuming here that the cryptographic material required during e-voting will be available to the voter in a very secure manner. Without this cryptographic material e-voting can not work.

In case if a person tries to register more than once the system will deny the second registration.

Two other possibilities of cheating can take place, registering died persons (some one with access to the ID of the late person) and if some one does not satisfy the requirements of registration. To stop this, the Government should make a data base that contains the population of the country (i.e. Eligible and non-eligible); this data base will contain the names and the national ID of all peoples then the list of eligible for election will be generated according to the conditions or statements like if a person is at the age of eighteen or above (i.e. age>=18) is allowed to vote else not allowed. The list of eligible voters must be updated up to the day before opening the registration process.

Another method which can be used is to create a data base of only eligible peoples. This list of eligible people which is made during pre-election will facilitate the data base manager to recognize during registration if the person who is registering is eligible or non-eligible to vote.

It is in this pre-election phase where the candidates for any particular type of election will start to submit their candidatures online with submitting all the documents required to the concerned registration office according to the criteria required to be a candidate, and then

the list of selected candidates will be available online. Those allowed may do their campaign online as well as doing the tours to the different corners of a country depending upon to the given time to explain their feature plans for the country. Then the people will choose the good candidates according to how they have convinced them during the campaign.
In conclusion, the outcome of the registration phase is a set of tables; List of eligible voters, list with voters intended to use e-voting and a list of the candidates who are running for election.

5.3. During election

In this phase the registered voters are choosing their candidates. This can take place in the ballot centers, or electronically by the voters who expressed that during the registration phase. We are concentrating here on the electronic voting option.
Some of the important factors controlling this phase are:

- The protocols used for voting that must fulfill the highest possible security measures.
- The protocols must be designed to guarantee all the requirements of democratic, transparent, and secure election.
- The infrastructures used to implement the security requirement and which, at the same time, be friendly to the voters.

All the topics will be the subject of the next chapters of the thesis.

6. Interest of the study

The following actors are going to benefit accordingly from this research

- **Researcher:** He/she will apply techniques and knowledge acquired from various courses at the university.

For example: Network Security, Research Methodology, Network Management and so on.

- **Students:** the research will help students who would like to venture into the same discipline

- **Population:** The country will organize any type of election and to inform the population it will be very easy and facilitate them to participate to the event in the right time as requested by an election counsel.

7. Hypothesis

All research works are normally guided by hypothesis that needs to be approved or rejected after the research. It is in this context that my research will be guided by the following hypothesis **"**It is possible to identify the complications of E-voting and to find out feasible solutions which would facilitate in performance optimization in terms of effective Voting".

8. Questions of the research

How Rwandan's vote in the current system
What is the dilation of the election?
How far the people are satisfied
How e-voting is used
Where is it used?
How can e-voting be implemented in Rwanda?
What are the requirements for e-voting to be implemented in Rwanda?

9. Study objectives

The main objects of the thesis are:

- **a.** To give the general description of the technical and organizational System of the planned e-voting system,
- **b.** To define the scope of e-voting, in other word defines the subject in the context of the election process as a whole,
- **c.** To specify the system requirements especially the security requirements,
- **d.** To analyze the system requirements and propose possible ways and techniques for implementing them,
- **e.** To specify the participating parties of the system and describe their roles,
- **f.** To specify the architecture of the e-voting system, the general description of functionality, protocols and algorithms,
- **g.** To analyze some of the existing systems and to describe possible security hazards and examines the compliance of the systems to security requirements,
- **h.** To propose some voting protocols that fulfills the security requirements,
- **i.** Give the corresponding structure of the system.

10. Scopes and limitations of the study

The project will give a general overview of E-voting System, the effectiveness of the implementation of this system in the Country. E-voting system will be used to encourage the big number of the voters to participate to the election. The people will vote from any where they are. No error in the tally of the votes. The result is published in short time.

The limitation is that this project is showing how the voting can be used in our country and the test will be done by using coding in only three machines

A general overview on actual situation about e-voting is presented followed by the implementation manner in different countries.

This study is limited to simulation. Due to the lack of required infrastructure and associated software, the project has not been implemented at any electoral institution.

11. Structure of the thesis

After the introductory chapter, chapter 1, electronic voting characteristics and requirements will be presented and discussed in chapter 2

The ten security requirements will be analyzed in details in chapter 3

Besides analyzing each of the requirements, some ways are proposed to implement each of them. The analysis and the proposals are important in designing any e-voting protocol. This is taken into consideration in chapter 4 in which we introduced some possible e-voting protocols.

We will analyze each protocol and evaluated it with respect to the number of the security requirements that it implements. Two of the proposed protocols can easily implement nine of the security requirements. The architecture of the proposed system is the subject of chapter 5.

The system will be simulated and its functionality will be checked. The thesis ends by conclusion and recommendations.

12. Proposed development

- The first year of research training helps the literature review to refine the research question in order to continue to make contacts with disability support staff, e-learning staff in other institutions.
- The second Year is Piloting of tools to be applied in the development of research techniques
- The third Year is to maintain empirical phase.
- The fourth Year is to analyze the literature review
- The fifth Year is to Complete writing up

Conclusions

In this paper, we have proposed e-voting system which can tackle all earlier issues encountered in a conventional (manual) voting system. The new system maintains voting statistics in real-time while preserving the integrity of the voting process from the minute a voter steps in to cast his/her when the cast vote is registered in favor of the candidate at allocated data base repository. While observing voting transparency, in the system levels, the proposed system is capable of denying access to any illegal voter/s, preventing multiple votes by the same voter, and blocking any introduced forms of malice that can affect the voting process. Moreover, the proposed voting system caters for the needs of the physically challenged voters by providing special multimedia amenities that would facilitate voting to a voter's convenience.

In the application of e-voting system, as the one proposed in this paper, many of the issues, can affect the traditional voting systems in the past, are assured to be to provide peace of mind to both voters and election candidates. It is well expected to administer/design e-voting system, countries that have been observed by international monitoring bodies, while carrying out election processes of their own, will soon be able to work on their own and achieve the election integrity they have longed for.

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