A Roadmap towards the Implementation of an Efficient Online Voting System in Bangladesh

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***Abstract*—Online voting system has become an interesting topic in recent years and most governments in Europe and elsewhere are taking steps to experiment as well as implement it to a great extent. Recent election problems in Bangladesh have sparked great interest in managing the election process through the use of internet. The present form of voting in general elections is founded upon entirely paper based and largely manual voting procedures. New technology for managing elections may entail several advantages. It may enhance the voters' scope for participating in the election as well as create scope for more rapid tallying of votes and distribution of seats. This enables the election commission to promptly announce the election results within a short time. The risk of error in vote-tallying can also be largely eliminated and through all these steps, the elections can be made fair. In this paper we have proposed an online based voting system to eliminate the problems and bottlenecks of the traditional voting system in Bangladesh.**

Keywords- Online Voting System, Voting in Bangladesh, Electronic Voting System.

I. INTRODUCTION

Online voting system is considered as a particularly interesting topic in the field of information security research. This may be due to a number of reasons. Election is the way through which people choose their representatives and express their preferences for how they will be governed. Naturally, the integrity of the election process is fundamental to the integrity of democracy itself [1]. Again, elections usually have high media coverage, especially if something goes wrong. Furthermore, online voting system seems to have a unique combination of security requirements: voters need to be authenticated as well as results need to be verifiable. So the online voting system should be sufficiently robust to withstand a variety of fraudulent behaviors and also must be transparent and comprehensible enough so that voters and candidates can accept the results of an election. Unsurprisingly, previous election history in Bangladesh is littered with examples of manipulated elections in order to influence their outcome.

A good voting system must satisfy a number of sometimes competing criteria. The *anonymity* of a voter's ballot must be preserved, both to guarantee the voter's safety when voting against a malevolent candidate, and to guarantee that voters have no evidence that proves which candidates received their votes. The existence of such evidence would allow votes to be purchased by a candidate. The voting system must also be *tamper-resistant* to thwart a wide range of attacks, including ballot stuffing by voters and incorrect tallying by insiders. Voting systems are hard to make trustworthy because they have strong, conflicting security requirements: Integrity and confidentiality [2]. *Integrity* means election results must be assured so that all voters are convinced that votes are counted correctly. Any attempt to corrupt the integrity of an election must be detected and correctly attributed. On the other hand, *confidentiality* means voters must be assured about the privacy of their votes, prevent selling of votes, and defend voters from coercion. Integrity is easy to obtain through a public show of hands, but this destroys confidentiality and confidentiality can be obtained by secret ballots, but this fails to assure integrity. Because of the civic importance of elections, violations of these requirements can have dramatic consequences. A voting system must be comprehensible to and usable by the entire voting population, regardless of age, infirmity, or disability. Providing accessibility to such a diverse population is an important engineering problem and one where, if other security is done well, online voting system could be a great improvement over current paper systems.

Previous researches on electronic voting system [3, 4, 5, 6, and 7], argue that assurance in electronic voting systems is too hard to obtain and that their deployment creates unacceptable risks. Our work, however, was inspired by the possibility that the proposed online voting systems could be more trustworthy and also efficient in terms of cost and time than the traditional voting system in Bangladesh.

The organization of the paper is as follows: section 2 briefly discusses the steps of the proposed system. Section 3 describes various features of the proposed system. A comparison between the present voting system in Bangladesh and the proposed system is mentioned in Section 4 and Section 5 includes conclusion.

II. SYSTEM OVERVIEW

The proposed system comprises of several steps. The system is accessible from two sides: (a). Election Commission who is the administrator and (b). The voter. There are some steps which are automated i.e. not accessible from any side. Figure 1 shows the possible input output scenario of the proposed system and total system architecture is presented in

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detail in Figure 2. Steps of the proposed system are described in the following sub sections.

A. Adding Voter Information

In this proposed system, information of each voter is added according to their National Identity Number. This National Identity Number is unique for each voter and this number is also used to identify the constituency of the voter. After adding information, an auto generated e-mail is sent to the e-mail address of the voter notifying him/her about the information and this e-mail also contains a computer generated password which can be used by the voter for login as well as for changing password and setting verification keys. Here verification keys are used to protect "Vote Purchase" and to ensure security. On screen keyboard is used to take the new password from user. The system will not take the password typed in any keyboard other than the onscreen keyboard. Purpose of using on screen keyboard is to prevent capturing password through any software if the voter changes password from any cyber café or in any public computer. Discussion about the use of verification keys is presented later.

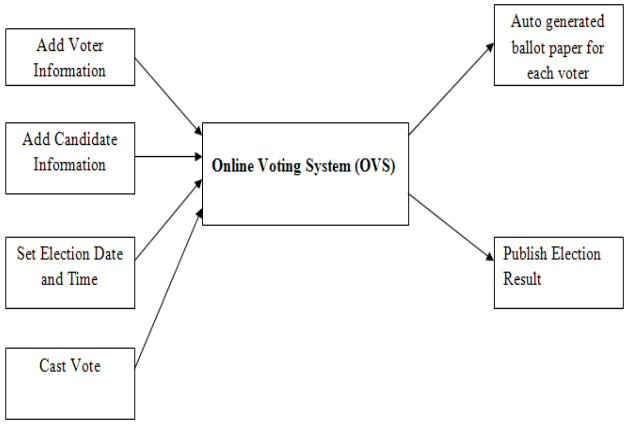

Figure 1. *Possible Input-Output scenario of the proposed Online Voting System*

B. Adding Candidate Information

Candidate information is added according to the constituency. Here each candidate is assigned an auto generated code to identify uniquely. Party symbol and candidate profile image are also added with other information in this phase.

C. Setting Election Date and Time

In this phase, starting time and ending time of election along with election date are set by the election administrator. Bangladesh is in the "Dhaka" time zone which has +6.00 offset from GMT. The voting server is configured according to this time zone. Voters who reside outside of Bangladesh can cast their vote according to the local time in Bangladesh during Election Day.

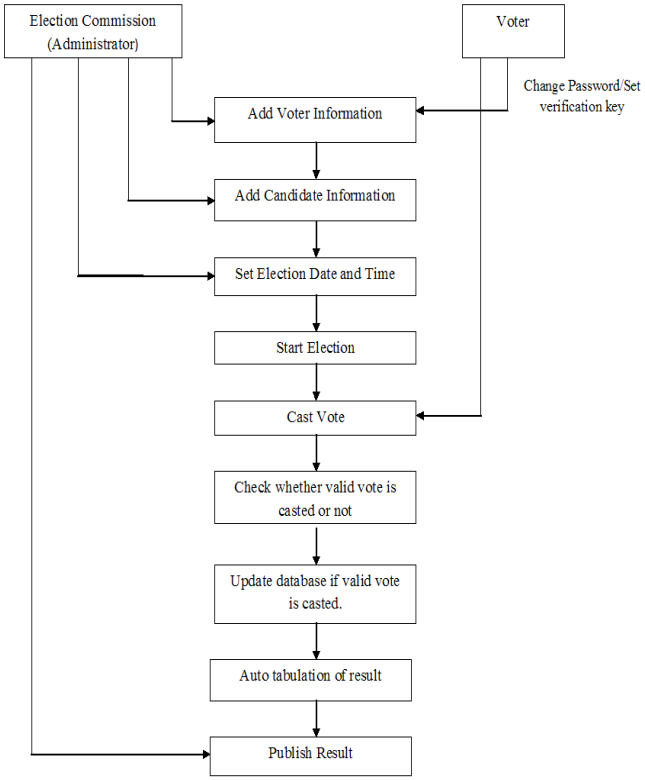

Figure 2. *Details architecture of the proposed system*

D. Start Election

This is an automated phase. During the stipulated date and time, election is started. Voter can cast their vote within this time period. If anyone wants to cast vote before or after the specific time period, an alert message is shown.

E. Cast Vote

In this phase, voter has to login first. After logging in with the national id and password, the constituency of the voter is determined from the information stored in the voter database. An E-Ballot paper is created automatically for that constituency from information stored in candidate database. This ballot paper contains the candidate name along with their profile picture, party name with party logo and a radio button to select the candidate for casting vote. There is also a "No" option if the voter is not interested to cast vote to any of the available candidates. Figure 3 shows a sample ballot paper for a constituency.

Voter selects radio button of the corresponding candidate and finally press the "Cast Vote" button. A security checking is done to verify whether the vote is casted actually by the voter himself. A discussion about the security checking is presented in the next section.

F. Security Checking

When a voter presses the "Cast Vote" button in the e-ballot paper after selecting the suitable candidate, a security checking is done internally. This security checking is one of the most striking points of this proposed system as it is required to

protect “Vote Purchase” by any candidate. Figure 4 shows the steps of the security checking process.

E-Ballot Paper for the Constitution: Chittagong 1

Candidate ID	Candidate Image	Name	Logo	Party Name	Select
C14		Mr. M		Bangladesh Awami League	○
C15		Mr. N		Bangladesh Nationalist Party	○
C16		Mr. O		Jatiya Party	○
C17		Mr. P		Jatiyo Samajtantrik Dal	○
C18		Mr. Q		Communist Party of Bangladesh	○
C19		Mr. R		Workers Party of Bangladesh	○
No	N/A	N/A	N/A	N/A	◉

Cast Vote

Figure 3. *A sample E-Ballot paper for a constituency*

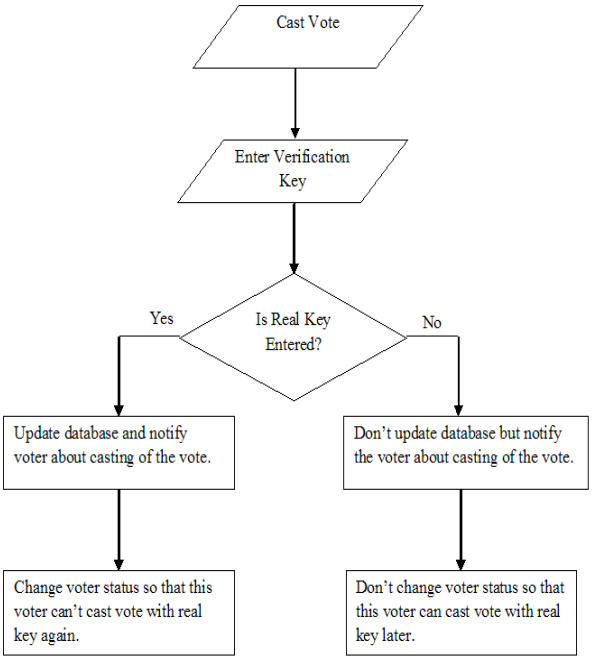

Figure 4. *Flow Diagram of the Security Checking Process*

Voter can enter verification key before election by logging in his/her account as we mentioned in section A. Number of verification keys to be used are selected by the voter, but among them, only one key is used as “Real Key” and rest of them are treated as “Fake Key”. Among these keys voter will select which one will be used as “Real Key”. In case of any attempt to “Purchase Vote” by any candidate, the voter has the option to hide “Real Key” and supply only “Fake Keys” to the candidate. If vote is casted by using fake keys, notification will be shown as if vote is casted successfully, but there will be no update in database. So if the voter wants to cast his/her vote, he/she can cast vote using the real key in any time within the voting period. This process will reduce the tendency of purchasing vote by any candidate and hence make the election process fair.

G. Auto Tabulation and Publication of Result

During the election period, result is tabulated automatically and after the election period is over, winner in each constituency is declared automatically. In this proposed system, results can be published immediately which leads to a huge saving of time than the existing method.

III. FEATURES OF THE PROPOSED SYSTEM

The features of the proposed system are:

- No need to stay in the queue for a long time to cast vote, anyone can cast his/her vote from anywhere through internet.
- Increased voter turnout.
- The cost for arranging election will be reduced as there is no need to prepare any voting center or no need to manage huge manpower.
- Impervious security checking to verify whether vote is casted by the voter himself.
- Coercion resistant voting system.
- Result can be published within a very short time as the system automatically tabulate the results and declare winners.
- Overall, the election will be fair enough and transparent.

IV. A COMPARATIVE STUDY BETWEEN THE PROPOSED SYSTEM AND THE EXISTING SYSTEM

To compare with the existing system, the proposed system was implemented in the trade union election of Technocrats BD on February 2010. The election system was totally online based and the previous elections were paper ballot based like other traditional elections. Comparative statistics between these two election methods are shown in Table 1.

Table 1 shows that the proposed system increases voter turnout than the previous method as online voting system is very much convenient than the traditional voting system. In this proposed system voter cast their vote from any place through internet rather waiting in a queue for long time and

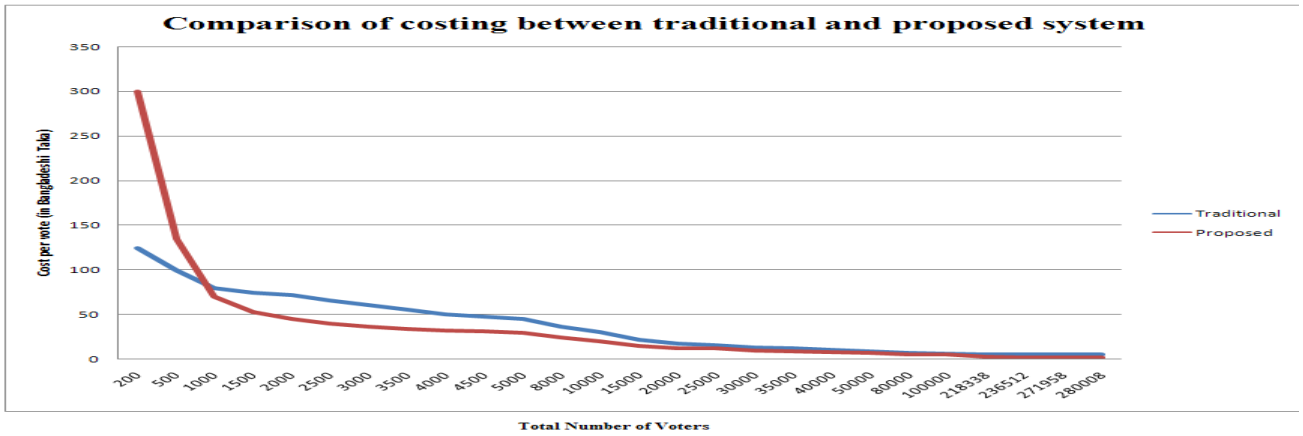

Figure 5. *Comparison of costing between traditional and proposed voting system*

this is the main reason for making the voting system interesting which leads to the increase in voter turnout.

From Table 1 it is also clear that there is no way of invalid vote in the proposed system which is a case in the traditional one. As the e-ballot paper contains radio button for each candidate, voter can select only one candidate at a time for the same post. If the voter doesn't select corresponding radio button of any candidate, "NO" vote is casted which means the casted vote doesn't correspond to any candidate. So there is no way of either casting multiple votes in the same ballot paper at a time or cast vote without selecting any radio button. That's the reason of 100% valid vote in the proposed system.

TABLE I. COMPARATIVE STATISTICS BETWEEN TWO ELECTION METHODS

Criteria	Paper Based Election on January 2006	Online Based Election System on February 2010
Total Voter	1054	1173
Turnout	797 (75.6%)	1053 (89.8%)
Valid Votes	753 (94.47%)	1053 (100%)
Total Cost (in Bangladeshi Taka)	84,320	82,110

Another striking point of the proposed system is the reduction of cost to arrange an election. Lots of manpower and funds are required to arrange the election in the traditional manner. But in this online voting system, there is no need of setup cost for any voting center as voters can cast vote from their personal computer and hence no manpower is required to maintain any voting center. Few people are enough to manage the complete process of the proposed system as many steps are fully automated. Huge reduction of cost is clear from Table 1.

In the traditional system, 80 Bangladeshi Taka is required for each voter where as only 70 Bangladeshi Taka is required in the proposed system when total voter is 1000. With the increase in total number of voters, total cost to arrange election in the proposed system decreases rapidly than the traditional system which is shown in Figure 5.

Finally, after this comparative study, it can be said that better turnout and strong security system with low setup cost have made the proposed voting system better than the traditional system.

V. CONCLUSION

This paper describes the design, implementation and evaluation of an internet based efficient voting system in Bangladesh. To our knowledge, this has not been done before. The proposed system is coercion resistant and provides stronger security than the traditional voting system. Experimental results show that cost, tabulation time and security can be practical for real-world elections.

Deriving from the previously-known voting scheme, the implemented system ensures security and efficiency through technical advances. But perhaps the most important contribution of this work is evidence that secure online voting system could be made possible and we are optimistic about the future of the proposed system which abides by the principals of electoral system.

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