E-Voting: Possibilities and Challenges in the Nepalese Context

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With the recent advances in the modern technology, typically in the networking field, "e-voting" is emerging as an attractive option over traditional balloting. Traditional paper balloting requires cumbersome manual work, a huge budget, and a substantial amount time for the overall election process. In contrary, e-voting, a faster and more economical approach, can be effective alternative in countries like Nepal where the infrastructure is poor and the population highly dispersed. This presentation discusses the potential of e-voting in the context of Nepalese society, both in and out of the country. It showcases the pros and cons of this state-of-art technology; the core issues being security and scalability. Also presented are the the author's experience with the implementation of e-voting software during the election in a Nepali organization. The presentation ends by highlighting some of the most prominent issues that need to be addressed in the Nepalese context- education, infrastructure-building, and policy-making.

I. INTRODUCTION

The advances in the networking field - the Internet in particular - has revolutionized our social activities. As the world changes into a ubiquitous society, it is evident that mobility, time, and cost play important role in our choices. Considering these "parameters" that decide choices, e-voting is emerging as an attractive option for governments and organizations as an alternative to traditional paper balloting. Traditional paper balloting requires cumbersome human involvement. It is also lengthy, tedious, and costly. In contrary, e-voting requires less human intervention and is, therefore, more economical. Most important of all, with its adaption, the total election time is largely shortened.

In the recent years, e-voting has been adapted in all elections in India and Brazil. Countries such as Venezuela, Netherlands, UK, USA, and Switzerland have used this technology in several scopes, ranging from municipal elections to national polls and referendums. Other countries, including Nepal, are cautiously following this trend. In a few years, e-voting is set to replace traditional paper balloting in most countries. E-voting: technology and its adaption, focuses the outline of the discussion we make in this paper.

The rest of this paper is organized as follows. Section II highlights the underlying technology. In Section III, we discuss on the implementation in Nepalese context. Experiences and future challenges are presented in Section IV. Section V concludes the paper.

II. TECHNOLOGY

The first half of this Section introduces various methods of e-voting. The later half then showcases the advantages, concerns in using e-voting systems. It also discusses the ways to address some typical concerns.

A. Paper-based E-voting

In this method, votes are marked by hand and are counted electronically. Examples include punch-card voting system - which came in controversy during the 2000 US Presidential elections - and optical scan voting systems such as marksense and digital pen [2].

B. Direct-Recording E-voting (DRE)
DRE systems usually have touchscreens for casting the ballot. Voters activate the electro-optical component and run the vote tabulating software. Hence, each vote is counted as it is cast. Depending upon the specification, the system may also have additional functions such as printing results and transmitting the individual ballots and/or results to a central location. Electric Voting Machines (EVMs), introduced by India in 2004 and also used partially in the 2008 Constitutional Assembly (CA) elections of Nepal, is an example DRE system.

C. Public-Network DRE (PN-DRE)
A Public-network DRE transmits electronic ballots across networks, typically the Internet, to a centralized location where ballots, collected from several stations, are counted. Corporations are increasingly adapting this method to elect their officials and board members. Such practices have been successfully deployed in public elections in Switzerland and Estonia [3].

E-voting systems offer several advantages over traditional paper balloting. The primary benefits are time and cost. With the automatic vote counting function, results come out within a short span of time. Traditional balloting require mobilizing a large number of election officials and, consequently, a significant part of election budget is spent in human resources. Such cost is largely reduced if e-voting systems are used. Recently, DRE and PN-DRE are gaining popularity on the grounds that they significantly simplify the election process. They can also provide a technical solution to a variety of common voter errors. For example, they can be designed so as to prevent voters from selecting two candidates for the same office, or alert voters if they fail to cast a vote on a referendum question, or provide a "confirmation page" where voters can check their selection before submitting the ballot [1]. The advantages are more prominent in PN-DRE, with the adoption of web-balloting. Votes can be cast "wherever" and "whenever". Many people live and work in places that are different from their registered voting areas. With PN-DRE, physical locations and election-day weather conditions no more become barriers. Proponents of PN-DRE argue that, such systems are likely to attract young voters, who generally are more computer literate. PN-DRE systems can, further, assist voters on voting decisions, by providing links to candidates' manifestos.

The main concern critics have against e-voting is that, votes are not physically visible. Some of the issues raised include: system bugs, voter identification, fraud, security threat from hackers, and system limitations such as the number of votes the system can handle. Most such issues, however, can be technically addressed. Concerns of voter identification and security threats can be addressed using keys and secret codes [3]. System bugs can be reduced with testing while minimizing threats from computer hackers require implementing strict laws and regulations.

III. IMPLEMENTATION POSSIBILITIES IN NEPALESE CONTEXT

E-voting is an attractive option for Nepal. The budget of the Election Commission of Nepal (ECN) is getting higher during every election - Rs 0.11b in 1991 (HoR), Rs 0.25b in 1994 (HoR), Rs 0.36b in 1999 (HoR), and Rs 2.73b in 2008 (CA) elections [4], thanks to he country's drastic geographical topology, highly dispersed population distribution in remote areas, poor infrastructure, high inflation, and the phase-wise election system. Introduction of DRE systems can reduce the total election cost. PN-DRE can further reduce the time and cost that is currently needed to carry booths to district headquarters. Hence, any potential physical attack on the ballots can also be avoided.

A large bulk of Nepalese population, in what nowadays is known as Non Resident Nepalese (NRN), reside in foreign countries. Implementation of DRE/PN-DRE is mandatory in order to include the voices of NRNs, who now are the main force in sustaining the country's economy, in the election process.

The adaption of user-friendly DRE in Nepalese context is not a challenging task. The successful implementation of EVMs in Kathmandu during CA 2008 has shown encouraging results. A step further is to extend the implementation in the national basis.

The scope of PN-DRE systems extends to various Nepalese organizations whose members are connected only by the web. Examples of potential PN-DRE implementations include the elections of NRNA, Nepalese Engineering Association (NEA), International Nepali Literarture Society (INLS), and student associations in various countries.

IV. EXPERIENCES & CHALLENGES

EVMs were successfully implemented in some areas in the 2008 CA elections in Nepal. The most obvious distinction in EVMs-implemented area compared to other areas was the early outcome of election results.

Nepalese in diaspora have also been using electronic means for voting. Some of them use email voting, a very preliminary way of accumulating votes at a central location. Its only difference from the Paper-based E-voting is the medium of the vote accumulation. Its major drawback is the lack of anonymity - voter privacy is not protected. Such methods are likely to draw confusions and fraud in the election process.

eChunab, a voting software designed by the author, is a web system based in MySQL and php. This software encrypts User-ID and User-IP-address and sends the cipher to the Election Officials (EOs) along with the votes. Encryption helps protect voter confidentiality while the database-check prevents the risk of multiple voting. The web interface further provides check functions in case too many or too few votes are submitted. Hence invalid votes are prevented. eChunab was implemented during an election of a Nepalese organization in 2009.

eChunab2.0, a PN-DRE system and an extension of eChunab, goes a step further to count the votes itself. It provides separate interfaces for the EOs and the voters. EOs can freely add/delete and fix/change election positions, candidates, the number of candidates to be elected. Such changes are dynamically reflected in the voters' interface. Prior to the election, EOs decide the candidates and the voters' list. After the election time is over, EOs can "shut down" the election process. The database table in the server side keeps track of each vote as it is cast. The results are displayed immediately after the election is over. Logs of each votes are also traced in encrypted form. In case of disputes, EOs can settle use such logs to check if irregular votes have been submitted. eChunab2.0 is yet to be run in production environment.

There are several challenges in implementing e-voting systems in Nepalese context. Education and policy making are the primary areas that need attention. Voters as well as candidates should be explained about how the system works. Considering the fact that votes are not physically traceable, unlike paper balloting, pre-testing is necessary.

Security is a primary concern in e-voting systems. In order to ensure the protection of the data and the device, strict security measures need to be provided and regulations be strictly followed. In case of PN-DRE, creating Virtual Private Networks (VPNs) can prevent eavesdropping in the network. Scalability is another area that needs a thorough discussion. Owing to the life-cycle of DREs, investments should be made in periodic basis. Hence, purchasing/manufacturing should be well planned ahead in order to reduce the cost. The development of DRE and PN-DRE systems should be well monitored in order to avoid any fraud during the development process. Mock elections are also necessary to test the systems. In order to sustain PN-DRE, proper permanent Information Technology (IT) infrastructure build-up is also required.

V. CONCLUSIONS

E-Voting is immerging as an attractive alternative to traditional paper balloting in terms of mobility, time, and cost. This paper introduced the technology behind e-voting and discussed the scope of this technology in the Nepalese context- both in national level elections and organization level elections. Some experiences with existing technologies were presented. We then discussed some challenges in implementing this technology in Nepalese context. We highlighted that with proper education, policy making, and deployment, e-voting can reduce the election cost of Nepal and at the same time shorten the overall election duration.

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