

Preliminary Investigation - Project Part 1

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Introduction

The election crisis of 2000 brought the flaws of the election system to the public eye, forcing investigations into the methods used by all states for voting and calling for major improvements to these methods. Currently, each county in each state is responsible for their own method of voting, whether at poll sites, by mail, or even by the Internet, which a few states have implemented for trial runs. Regardless of the method used, each system is intended to accomplish the same goal – determine the winner of the election based on the votes submitted. A report done by the National Science Workshop on Internet Voting [5] stated a list of criteria that all election systems should follow in order to reach this goal:

*Eligibility and Authentication of voters
Uniqueness of vote
Accuracy of the record of the vote
Integrity of the vote
Verifiability and Auditability of the vote count
Reliability of the election system
Secrecy and Non-Coercibility of the vote
Flexibility of election equipment
Convenience for the voters
Certifiability of the election system
Transparency of the voting process
Cost-effectiveness of the election system*

As will be shown, these criteria are the ideal to be followed for the election systems, but not necessarily the reality. The reality is that none of the election systems abide by all the criteria and, as a result, run into serious problems. Some proposals that claim to solve these problems in theory prove to fail in practice. The state of the art and the problems of electronic voting at poll sites will be the focus of this report. In doing this, a challenge will be set in order to rectify these problems.

State of the Art

Many people are opposed to the idea of remote poll site electronic voting. The foremost issues in the computer community are regarding software security and certification. Rebecca Mercuri's [8] statement on electronic voting highlights some of these concerns. She expresses concern about the fact that there is no standard electronic ballot format. Therefore, a computer ballot can be made to cause more confusion. Also, if the election process becomes fully automated, it removes any opportunity to perform manual checks. She further goes on to say that even the best cryptographic systems can

be broken into and this can potentially compromise the accuracy of the votes and privacy of a large number of voters. Mercuri is a proponent of a system that provides an indisputable paper audit trail.

M. I. Shamos [9] makes an argument against centralized software voting system. He presents a nightmare scenario where an unscrupulous programmer produces software that favors a certain candidate and that software is deployed throughout the country.

The flaws in the current election systems validate the above concerns. The Caltech/MIT report [6] highlights problems of some of the electronic voting equipment in use today. Specifically, the mechanical lever voting machines provide no ability to audit them and to "recount" individual ballots. The same problems occur with the Direct Recording Electronic (DRE) systems. In addition, there are issues regarding the time spent on these machines by a voter, which can be very high and result in low system throughput. Election systems that use optical-scan voting machines require voters to fill in an oval or connect dots on a paper ballot. The problem occurs when the voter improperly marks the ballot, causing the computer to count them incorrectly or reject them totally.

The equipment used in the election system is just part of the problem of poll site voting. The Caltech/MIT report unraveled many additional problems, including registration, ballot security and even the poll site process itself [6]. At the poll sites, there is often "rush hour traffic" during peak times, which can lead to discouragement for voters to wait in long lines to vote. Since voting is not something that happens very often, the process itself is unfamiliar and can be confusing to the voter. Also, workers at the poll sites are volunteers, primarily elderly, and must work the entire day. In dealing with ballot security, this could be an issue, since these older, tired volunteer workers will be guarding the poll sites. These problems with poll site voting are also important issues.

Moreover, the cost of switching to electronic voting systems may be well beyond the budget of most counties. According to a report by Lorrie Cranor [10], this might make the whole idea infeasible in the near future. There is also the problem that once a county does spend huge amount to acquire such a system, it will be tied down to it for a long time which will hamper future research.

System in Use

Countries that currently implement some sort of electronic voting are the USA, Brazil, Venezuela, Belgium, India, and the Philippines [1].

Belgium implemented electronic voting in 1991 because of the huge amount of time required to count their open electoral list ballots. Their technology includes storing data on a magnetic strip, and using a screen and light pencil to select options. This system was used by 44% of voters in 2000 elections, but has not spread to all polling places because of the expense [1]. In this scheme, the user is issued a magnetic stripe card at the polling place. The voter uses a light pen to select options, which are then recorded on the card. The voter carries the card to a "voting urn" and deposits the card. The vote

is then saved on a storage device [2]. This system automatically centralizes votes and verifies the results with the magnetic cards [4].

The USA uses a wide variety of electronic systems and automated counting systems, including direct electronic registration, lever machines, optical readers, and punched cards [1]. Internet voting was first tried in Alaska and Arizona in 2000, although the Alaska trial was not very successful: of the over 4,000 votes cast, only 35 were sent by Internet [4]. In the last presidential election, some military personnel cast ballots by Internet, although they also cast paper ballots at the same time [1].

Brazil has widespread electronic voting systems, with 109 million people voting electronically in 2000. The system involves an electronic ballot box and a numerical keypad. One interesting note is that their voting system is tailored to a largely illiterate population [1].

It appears that Venezuela uses some sort of optically scanned paper ballot system, with automated counting, totaling, and announcement of winners [1].

The Philippines briefly tried optically scanning ballots, but gave up on them after deciding they were too much trouble. India started using an electronic voting machine system in 1998. Voters choose candidates by flipping a switch [1].

Electronic voting is under study in many more countries, including Canada, Costa Rica, Argentina, Japan, Australia, Norway, Denmark, the UK, The Netherlands, France, Bosnia, and Spain. [2]

In light of these concerns for problems with election systems, a closer look will be taken at one propose voting system.

An Example Voting System

This was a proposal to take the first step toward implementing a new system for casting and counting ballots. It was entitled “The Voter Certified Ballot - A Proposal for Ballot Reform” by Alan Dechert [7].

The Hardware Setup:

- A standalone PC
- Printer
- The CPU and keyboard will be inaccessible to the voter
- Only the mouse, monitor and printer will be within reach of Voter
- The mouse will be a very simple one-button mouse
- Headphones for visually-impaired voter
- Utilizing a touch-screen monitor for voters who may lack sufficient eye-hand coordination
- PCs could come from existing inventories of government agencies

Key Features:

- Voter certifies machine reading of ballot before leaving polling place
- Over-votes not possible
- Traditional strengths of current system retained such as personal identification at the polling place and ballot anonymity
- Improved ability to meet requirements for ballots in different languages
- "Vote anywhere" capability -system can be set up so that a voter can vote at any polling place in the county

The actual voting process is as follows: the voter will check in at the polling station. Here, the poll workers will find the voter's name in the preprinted logbook ("roster") that is prepared for the precinct. The poll worker will put a check mark next to the voter's name. In case the voter is not on the roster, the voter's name and address will be hand printed on the roster by the poll worker. If the voter's address is within the precinct, the voter will be able to vote, but the ballot will be handled as a provisional ballot. If the voter's address is not within the precinct, the procedure depends on whether or not the county has enabled the "vote anywhere" capability.

The voter selects his choice of candidates on the PC running a ballot application. Then a printout confirming his choices will be printed. The voter places the ballot face down in the privacy folder and goes to the poll worker to deposit the ballot and "sign-out" on the roster. The certified printout becomes the authentic document. It is the actual ballot. This settles all issues related to whether or not the machine read the ballot correctly.

The electronic record of the vote (from which the printout was produced) will be encrypted. No one at the polling place will be able to view or manipulate the contents of the file.

As soon as the voter completes the process, the electronic file will be resorted by ballot number so that no one could later identify a particular voter's ballot by keeping track of the order of the users of the PC. The electronic record of the vote (from which the printout was produced) will be encrypted. No one at the polling place will be able to view or manipulate the contents of the file.

The record has ballot number, state, county, precinct number and list of ballot items selected by the voter. When the polls close, the electronic records of the votes are merged into a single file.

There are several layers of certification. First, the voter certifies his or her own ballot. Second, the poll workers at the precinct certify that the file transmitted to the county (and posted on the county web site) is accurate. Beyond that, there are procedures for the county to certify the accuracy of the counts.

However, this system has yet to be implemented.

Conclusion

As shown above, the current state of electronic voting at poll sites has problems, not only in the United States, but abroad as well. The move to Internet voting to rectify such problems creates newer problems. This lead to movements to propose new electronic voting schemes, such as Dechert's above, but it has yet to be implemented.

All these signs point to one thing: the current state of electronic voting is not adequate for the election system in the United States. Thus, new ideas need to be brought forth in order to improve the system. This is what we intend to do in our project.

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