Electronic Voting Machines (EVMs)

Pakistan Factsheet

Introduction

The use of electronic voting technology in elections was introduced in 1964 when punch cards and computer tally machines were first used in the United States (US) presidential primaries in two counties in the state of Georgia. Since then, other technologies like direct recording electronic (DRE) voting machines have been introduced in some countries to help improve the efficiency and transparency of voting/counting procedures. However, there are countries that had previously adopted these technologies and are now reverting to conventional paper ballots for various reasons.

Electronic voting machines (EVMs), are either electro-mechanical or electronic equipment that can be used to define ballots, cast and/or count votes, report or display election results, and/or maintain and produce audit trail information.

Types of EVM

DRE voting/counting machine

When talking about EVM, we mostly think of a DRE – a machine on which the voter makes the ballot choice directly without first marking a paper ballot, hence the "direct recording electronic". A DRE uses a keyboard, touch screen, mouse, pen or other electronic device to allow a voter to record his/her vote electronically. Some machines, including touch screen and selection wheel require voters to insert an access card to initiate the voting process, while others require an electronic ballot or access code. DRE is used in supervised locations – polling stations – rather than unsupervised environments such as Internet or SMS voting. It captures the voters' choices and stores them. The data captured by each individual DRE unit is then transmitted by either electronic means – such as the Internet, cellular or memory record – or manually – by printing the results from each machine and tabulating them. DRE machines have been used by several countries, including the Netherlands, Germany, India and Brazil. Some countries, such as India, continue to use the technology, while others have stopped for various reasons outlined below.

EVM with voter verifiable paper audit trail (VVPAT)

An optional feature of a DRE is a voter verified paper audit trail (VVPAT). A VVPAT device is connected with an EVM and acts as an independent verification system designed to allow voters to verify that their vote is recorded correctly using a paper record. The paper printout of the vote is kept in a ballot box either straight from the voting module (e.g. a "cut and drop" solution) or the voter will manually take the printout and put it in a ballot box. The electronic record of the vote is the primary source for the count, but the paper trail can be used to detect possible election fraud or machine malfunction and provides a means to audit the stored electronic results. India has been using VVPAT at a limited scale; it is also being used in some states of US.

EVM with paper ballot

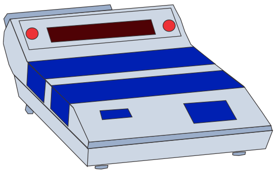
Another type of EVM is a machine where the choice is made on the machine itself, which produces a token on which the choices are recorded. The token is then placed in a ballot box (internal or external to the machine). The token can be a printout of the ballot choice or the ballot can be recorded on another medium. At the end of polling, all of the tokens/ballots are manually counted to determine the polling station's result[1]. This system was used in Belgium in 2012.

[1] http://www.e-voting.cc/wp-content/uploads/downloads/2012/07/199-211_Vegas_Belgian-E-voting.pdf

Sample EVM Unit

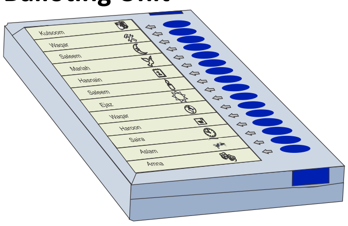
Below is an example of the components of the EVM model used in India.

Control Unit



The control unit is managed by a polling official. The control unit is attached to the balloting unit by a cable. Instead of issuing a ballot paper, a member of the polling staff pushes the ballot button on the control unit to prepare the balloting unit for the voter. When the last voter has voted, the polling official will press the 'Close' button, whereafter the EVM will not accept any more votes. After that, the vote tally for each candidate can be read in the display of the control unit.

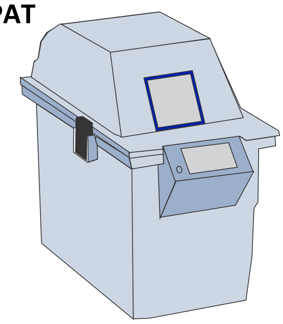
Balloting Unit



The balloting unit is placed behind a privacy screen. The voter can cast his/her vote by pressing a button on the balloting unit against the candidate and symbol of his/her choice. These names and symbols are listed on a piece of paper under a plastic screen. As soon as any button on the balloting unit is pressed, the vote is recorded for that particular candidate and the machine locks.

As soon as the voter presses the button, a tiny red light next to the selected candidate space glows and the machine emits a sound. Thus, there are both audio and visual indications to assure the voter that his/her vote has been recorded.

VVPAT



VVPAT is a printer attached to the balloting unit and placed behind the privacy screen. When a voter casts his/her vote, in addition to the red light glowing against the name and symbol of the chosen candidate, the VVPAT generates a paper slip containing the serial number, name and symbol of the candidate for whom the vote was cast. The paper slip remains visible to the voter through a window covered by glass on the printer and, after about five seconds, is automatically cut and dropped into the box permanently attached to the printer.

Benefits

The following points outline some of the benefits of EVMs:

- EVMs contribute to a faster vote casting, counting and delivery of the election results;
- They standardize the counting of ballots, improve counting accuracy and allow the results to be prepared in less time compared to a manual balloting system;
- They significantly reduce the margin of error in the vote casting and counting process by decreasing the chances of invalid votes;
- Depending on the design, the machines can be used easily by educated and uneducated voters alike. For example, on the Indian EVM the voter simply presses a blue button on the balloting unit against the candidate name and symbol of his/her choice and the vote is automatically recorded in the machine;
- The machines can help prevent certain forms of potential election fraud, such as stuffing of ballot boxes;
- It is difficult, though not impossible, to tamper with the machines.

Drawbacks

Despite the benefits mentioned above, EVM is not an instant solution for improving the electoral process. An EVM machine takes input from voters and produces outputs in a way that cannot be witnessed by external observers and election administrators. This is a potential problem for ensuring transparency, trust and integrity. The introduction of VVPAT has tried to address this issue, but not without involving the use of paper to verify the electronic votes - contradicting the very purpose of making it a paperless exercise. Some of the major drawbacks are listed below.

Loss of transparency

Transparency is essential in an election process. The defining challenge in the design of EVMs is to reconcile the competing requirements of transparency of the process and the secrecy of the vote. Only a few technical experts can understand the mechanics of EVM; for non-experts, it is an opaque system that cannot be fully observed. By contrast, a paper balloting system is more transparent and tangible for stakeholders who do not have a technical background.

Critics cite lack of transparency as a major reason that people in many countries are pushing back against the use of EVMs. California has rejected EVMs; Quebec and Italy have decided to forego their use. In Germany, the use of EVMs was first challenged based on the system's lack of transparency since a voter could not check what happened to his/her vote. The EVMs did not print receipts so, it was argued, the results could be manipulated. In March 2009, the German Federal Constitutional Court ruled that the EVM designed by the Dutch firm Nedap[2], used for the previous 10 years, was unconstitutional. The court was of the opinion that EVM technology invites a high risk of software programming errors or deliberate electoral fraud committed by manipulating the software, which cannot be easily recognized. In the court's opinion, the electors should be able to verify how their vote is recorded without having detailed computer knowledge. It is not enough for results to be tallied solely based on the processing of data stored in a machine's electronic memory[3].

Stakeholders' distrust

Stakeholder trust is strongly linked to transparency. It is notoriously difficult to build trust in EVM, as their operations are not easy to scrutinize and the machines have limitations and can be misused. Hence, the introduction of EVM is only recommended once there is proven and enduring trust in the system. According to the Council of Europe's handbook on e-voting, "it has become clear that e-voting systems cannot be introduced unless citizens and other stakeholders trust their political and administrative systems." [4]

Several countries in the world have rejected the use of EVM because they lacked stakeholder confidence. Ireland abandoned its EVMs only months before their planned use in nationwide elections in 2004. Key stakeholders, including opposition political parties, civil society and many citizens, lost their trust and confidence in the EVM "solution." The commission established to look into the matter concluded, "It is not in a position to recommend with the requisite degree of confidence the use of the chosen system …." The Commission emphasized, "that its conclusion is not based on any finding that the system will not work, but on the finding that it has not been proven at this time to the satisfaction of the Commission that it will work."[5] Finland piloted the use of EVMs in three municipalities (with traditional paper balloting also allowed). Acting on a complaint, the Supreme Administrative Court cancelled the results in these municipalities because of flaws in the procedures and instructions in the use of EVMs, and ordered new elections to be held. Later on, the government decided to stop using the technology.[6] EVMs are allowed in most states of the US only if there is a paper backup. Developed nations like the United Kingdom, France, Japan and Singapore have so far stuck to voting using paper ballots, owing to their simplicity, verifiability and voter confidence in the system.

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[2] Nedap is a Netherlands based technological company.
[3] http://history.edri.org/edri-gram/number7.5/no-evoting-germany
[4] "E-voting Handbook: Key Steps in the Implementation of E-enabled Elections", Council of Europe.
[5] From CEV's Interim Report, April 2004, available at www.cev.ie
[6] OSCE/ODIHR Needs Assessment Report 2011 http://www.osce.org/odihr/75599.

Software and hardware maintenance, storage and update

It is vital to keep EVM equipment in secure storage to counter the perception and reality that the equipment could be tampered with. Vendors provide support for maintenance, upgrades, configuration and reconfiguration in the period between elections, which creates the possibility for fraud. Dependence on vendors can be avoided by developing the capacity within the election management body (EMB) to conduct these tasks, but this requires significant technical training of EMB staff. This independent capacity can only be built over the course of several elections.

There is also a dire need for the EMB to be aware of any environmental conditions that are required when storing the EVMs, as the equipment may be sensitive to extreme temperature and humidity, or may require a dust free environment. Storage conditions are especially challenging in very hot countries, in terms of cost and availability, where extreme heat may degrade the reliability of the equipment.

Security

EVMs are computers, which run software, and the votes cast using an EVM are stored in a safe storage or space in the computer's memory. All software carries the risk of malfunction or manipulation. The time gap between voting and the counting of votes makes the process vulnerable to hacking and manipulation. The chance of tampering increases as the time gap increases. In the Netherlands, in 2006, licenses of 1,187 EVMs were withdrawn after a citizen group "We do not trust voting machines" showed they could hack into EVMs in five minutes from up to 40 meters away without the knowledge of voters or election officials[7]. Later, in 2008, the Netherlands banned the machines after a group of activists successfully demonstrated that both types of EVMs then in use could be tampered with.

The danger for EVM manipulations is not just from its software, but also the hardware. If a person can get access to an EVM, for instance, while it is being transported or assembled, there are several ways the machine may be manipulated. One is that the entire system can be replaced with an unauthorized one. A device could also be inserted between the ballot unit cable and take control of the unit. Another possibility is the chip that records the votes could be replaced with a fraudulent or malicious one.[8].

Financial consideration

The expected life span of an EVM is around 20 years, which means it can be used in several election cycles at both national and local levels. The initial investment cost should be considered in this light. However, EVM require safe storage between elections and considerable maintenance (battery charging/replacement) and configuration (testing and upload of election specific ballot configuration depending on constituency). This combined overall cost can be compared against the cost of printing physical ballot papers and the associated need for ballot boxes. Considering the increasing demand for VVPAT as a vital transparency measure, any potential cost saving through abolishment of paper ballot and ballot boxes is largely swallowed up by the procurement, storage, maintenance and configuration cost of the EVM.

[7] http://knowhowledge.com/website/staticpages/Featureidea/Featureidearequire/Votemach/votemach1bp.asp
[8] http://indiaevm.org/evm_tr2010-jul29.pdf

India's confidence in EVMs

No other country in the world has used electronic voting at as large of a scale as India. India is the second largest population in the world and, by default, the largest national population to vote using EVMs. However, it is important to bear in mind that India took 22 years from the initial introduction in 1982, to the country-wide use of EVM in 2004. One major reason for EVM acceptance in India is the high confidence of the electorate in the EMB.

The Election Commission of India had publicly affirmed their "faith in the infallibility of the EVMs," in 2009, saying that, "they are fully tamperproof."[9] That confidence was eroded when, months later, an academic study by Indian and international experts demonstrated specific vulnerabilities and problems with the use of the Indian EVM. The study concluded that, "…despite elaborate safeguards, India's EVMs are vulnerable to serious attacks. Dishonest insiders or other criminals with physical access to the machines at any time before ballots are counted can insert malicious hardware that can steal votes for the lifetime of the machines. Attackers with physical access between voting and counting can arbitrarily change vote totals and can learn which candidate each voter selected. The design of India's EVMs relies entirely on the physical security of the machines and the integrity of election insiders."[10]

Conclusion

There is no clear answer to which voting, counting and results process is best – manual, mechanical or electronic – since all three have their unique uses and advantages, and every country has its own distinct circumstances. Looking at the benefits and drawbacks of the EVM technology, a broad range of stakeholders should carefully consider the cost to the nation, and risks involved in a disputed election process before making a decision on using EVMs. It is critical to conduct a comprehensive pilot project in different environments and at different levels (urban, rural and the most remote areas) before making a decision. Organizing hacking competitions where computer scientists and other interested parties are invited to find external vulnerabilities in the EVM to test the system is also a good exercise. Apart from financial implications, the outcome of a pilot project should take into consideration the stakeholders' trust and input.

Additional reading

IFES, 2011: *Electronic Voting & Counting Technologies: A Guide to Conducting Feasibility Studies*[11]

IFES and NDI, 2013: *Implementing and Overseeing Electronic Voting and Counting Technologies*[12]

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[9] See http://eci.gov.in/eci_main/press/current/pn080809.pdf

[10] "Security Analysis of India's Electronic Voting Machines", Prasad, et al, Proceedings of the 17th ACM conference on Computer and Communications Security, October 2010. http://dx.doi.org/10.1145/1866307.1866309. Also available at http://indiaevm.org/paper.html

[11] http://www.ifes.org/Content/Publications/Books/2011/Electronic-Voting-and-Counting-Technologies-A-Guide-to-Conducting-Feasibility-Studies.aspx

[12] http://www.ifes.org/Content/Publications/Books/2013/Implementing-and-Overseeing-Electronic-Voting-and-Counting-Technologies.aspx