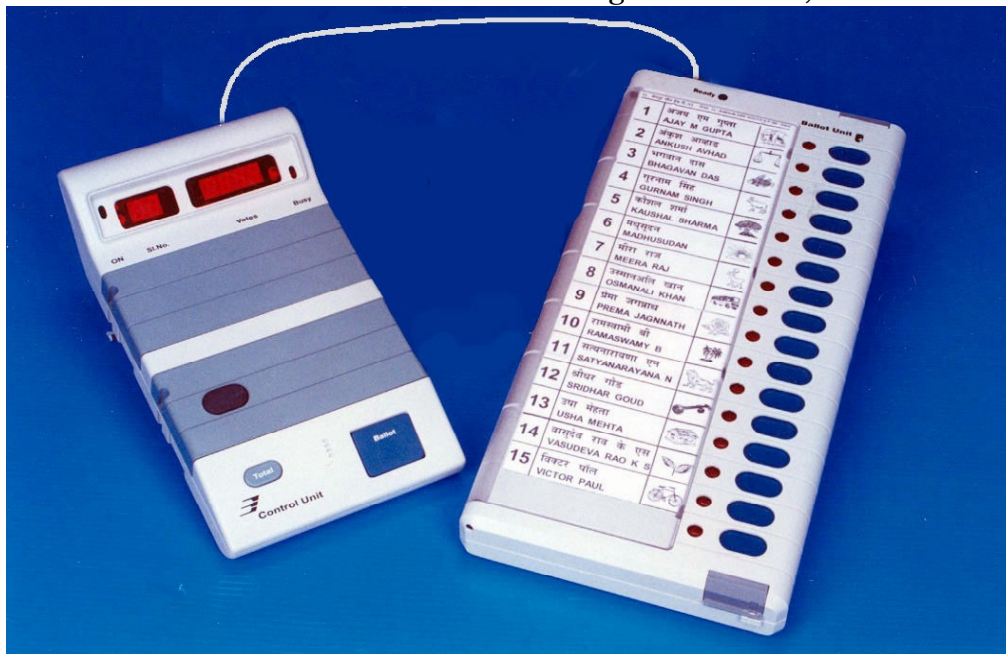


Electronic Voting Machines

from **Bharat Electronics Limited, India**

The world's largest democracy with 671 million voters went to polls in April –May 2004 and elected a Government of their choice using the most powerful means of decision making in the world, The Electronic Voting Machine (EVM). Exclusive

awareness of its reliability and adaptability, so also the political recognition. All these have been achieved through a series of meticulously planned events like exhaustive training to the polling officials, mass awareness programmes to educate voters, especially the overwhelming majority of those who live in the remote villages of India, etc. Technical



use of EVMs across the length and breadth of a huge country like India came off splendidly and the unparalleled success of this bold and progressive experiment demonstrated to the rest of the world, the country's technological as well as grassroots democratic capabilities. About half a million of the EVMs deployed in these elections were designed, manufactured and delivered by Bharat Electronics Limited (BEL), a Public Sector Enterprise of the Government of India. Today, the Electronic Voting Machines have made an easy passage to India's hundreds of thousands of villages. There is widespread

experts from Bharat Electronics Ltd. worked untiringly alongside the Indian Election Commission officials offering support and assistance for these activities and also during the elections, ensuring that the whole process succeeded and it is remarkable that there have been no problems with the machines worth speaking about. The 2004 general elections in India, where millions of voters cast their votes through the electronic voting machines and the results of which were declared in one single day, was indeed a landmark success for the application of technology for sustained development of society.

Around the world, electoral officials are examining various technologies to address a wide ranging array of voting issues like:-

- ❑ System adaptability and acceptability by all stakeholders including common people residing in remote villages, probably some of them illiterate too
- ❑ System functionality as close to conventional ballot paper system as possible
- ❑ Cost effectiveness and ease of deployment / maintenance of the system
- ❑ System reliability and security in terms of tamper resistance, error free operation etc.
- ❑ Speed and efficiency of voting and results declaration

The machine and the process

It is in this context that the solution offered by Bharat Electronics Ltd (BEL) in India stands out as perhaps the best of available alternatives.

The Electronic Voting Machine (EVM) from BEL consists of two interconnected units, the **Ballot Unit** where the voter casts his vote by pressing a button alongside the name of the candidate and symbol of the party for whom the person chooses to vote for and the **Control Unit** by which the polling official enables the Ballot Unit for the voter to cast his vote and where all related data like number of votes polled for each candidate, total number of votes cast etc. resides. The voting sequence using the EVM (diagram below) has

been kept as close to the traditional voting process as possible.

Once the validity of the voter has been ensured, the Polling official enables the Ballot Unit and the voter is asked to go to the secluded area where the Ballot Unit is placed. There, the voter scrutinizes the names of the candidates / parties displayed on the Ballot Unit and casts his vote by pressing the blue button beside the chosen candidate's name / symbol. The corresponding LED is lit and an audible beep is heard confirming the registration of vote in the system. This process is repeated for the next voter. At the end of polling, the process is completed by the official by pressing the "Close" button on the Control Unit. On operation of the "Result" button of the Control Unit, the display indicates the results of the poll including total number of votes cast and the number of votes polled for each candidate.

Tamper Resistance

In order to maintain the integrity of the process and ensure adequate security in elections, a combination of technological innovations have been very successfully integrated into these machines.

- ❑ The program (software) is fused into an Integrated Circuit (IC) and is unalterable. These ICs themselves are hard wired and hence cannot be easily accessed or replaced.
- ❑ A unique serial number of the machine, embedded in the system, is validated automatically

before the commencement of operations. Any mismatches detected, being evidence of tampering, renders the system unusable.

- The Ballot Unit has to be activated by the Polling Official, using the Control Unit. Casting of a vote is prevented if the Ballot Unit is not enabled / activated by the official.
- A voter can cast only one vote. Once a vote is cast, the Ballot Unit is disabled automatically.
- The operation of the “Close” button by the polling official ends the poll after which the system does not accept any more votes.

CSDS study

A study conducted by the “Center for the Study of Developing Societies” (CSDS), a Non Government Organisation (NGO) brought out the following very significant observations on the usage of EVMs.

- About 97% of the respondents felt that EVMs were better than the marking system of Ballot Papers, one among many other advantages
- Quicker counting and early declaration of results was appreciated by the political parties, the contestants and the polling personnel.
- Menace of invalid votes was eliminated and the disputes among the contestants over the rejected votes disappeared
- No section of the people felt handicapped by the new system

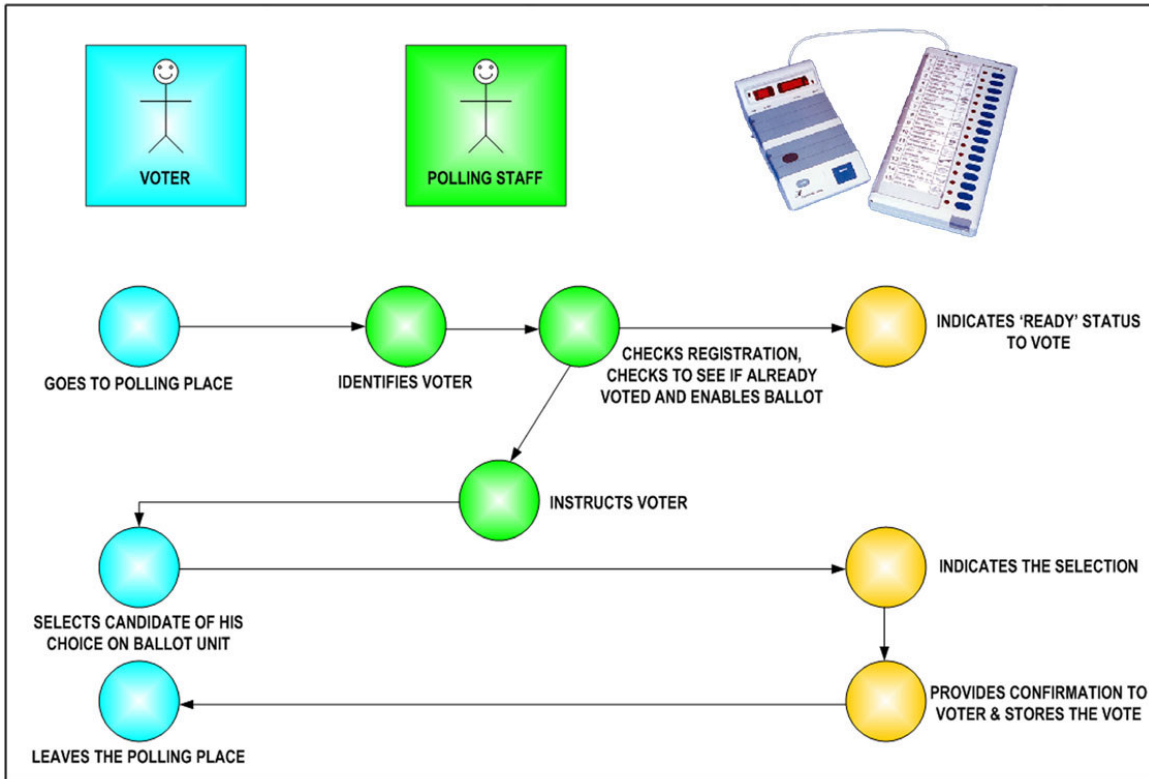
or lacked faith in such a seemingly non tangible way of voting.

Customisation

The pattern of electoral process varies from country to country. Recognising this variation and the need to address it, BEL has kept its R & D commitment ongoing to take up the customization and upgradation of the product for the global market. Since the machine has been designed and manufactured by BEL, implementing changes and introducing new features to the system, to meet the specific requirements of a country’s electoral process, are well within the company’s capability. Technical experts carry out country specific study of the electoral processes and customized, country specific machines are configured and demonstrated to the concerned officials and decision making authorities. Some of the features that have been designed and implemented are given below:

- Capability to handle elections to federal and local bodies simultaneously.
- Facility to the voter to change the selection before confirmation of vote.
- Provision to print “Voter Receipts” as paper trails confirming the cast vote and providing a back up.
- Option of recording “Null / Blank Votes” (for those voters who do not desire to make a choice.)

- Interfacing the Control Unit with automatically enables the Ballot



existing “Electronic Voter Registers”. The successful validation of voter identity

- Incorporation of Group representation, multiple candidates, preferential votes etc.

Comparison with other Computerised systems

The stand alone machines offered by BEL are not susceptible to most of the currently debated issues of security breaches or fault vulnerabilities and are under serious consideration for introduction by some of the established democracies of the world. Some of the important aspects contributing to this status are indicated below.

EVMs of BEL	Computerised Voting Systems
Customised and proprietary hardware and software	Commercial, general purpose hardware & Operating System.
Software fused permanently in	Software written in C, C++ etc which

Integrated Circuits; can not be accessed, retrieved or altered.	are unsafe for such applications and resident in Flash memories, which can be manipulated.
The unique signature of every controller used in the machine is checked for authenticity, generating evidences if tampered with.	General purpose Mother Board architecture do not provide such unique features
Voting data reside in double redundant EEPROMs; do not need any external back up battery for retention	Voting data generally resides in RAM with battery back up on Mother Boards and are vulnerable for corruption if battery fails.
Very similar in concept to the conventional voting, Ballot Unit replaces the Ballot Paper, Control Unit replaces the Ballot Box. Minimum change by automation	Conceptually very drastic change, ignores human metaphor, leads to low confidence level for a common voter
Very low investment in awareness campaigns and training	Being based on computers, voters need to be educated elaborately, high cost of training
Easy transportation, set up and operation, operates on battery. Very low Mean Time Between Failure (MTBF), more than 10 years of guaranteed life cycle, simple maintenance Cost of Ownership is extremely low	Mains operated, back up by UPS. Transportation and set up costs are relatively high Cost of ownership is high