

The E-Voting Trajectory – EVMS, the RVM Initiative in Various Election in India - A Comparative Study with International Benchmarks

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Abstract: India is a country with a lot of people more than 1 billion. India has a lot of voters than 668 million and India has 543 areas where people vote for their representatives. Voting is very important because it helps choose the people who will be in charge of the country and it shows what we think about how the country should be run. This paper talks about what other people have written about voting and the ways they think we can make voting. Voting is like a bridge between the people and the government. In the few years people have been paying more attention to the ways we vote. The way we vote now is not very safe. It is hard to be sure that everything is okay. So people do research to try to make voting so it is secret, fair and safe and so people cannot cheat. When we vote using computers and phones we still have problems with people trying to cheat and with keeping the systems working properly. Now people are doing research to make voting safe and fair and to make sure that peoples votes are secret. The idea of using a system that is not controlled by one person or group is becoming more popular because it could make voting easier, safer and more secret. A good voting system should be able to prove that it is working correctly. There are some reasons for governments to use electronic voting systems like making elections more active and reducing costs.. There are still some problems, with electronic voting systems because they cannot tell if the person voting is really who they say they are and they can be tampered with. This paper looks at what other countries have done with voting systems. It compares how different countries have adopted these systems.

Keywords: *Electronic Voting Machine, Invalid Votes, Audit Traits, Remote Electronic Voting Machine, Deepfakes.*

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I. INTRODUCTION

Electronic Voting Machine is an electronic device. It is used to record votes. This replaces ballot papers and boxes used in the voting system. The machine is easy to use. Both polling staff and voters can operate it. The machine works alone. It does not connect to any network. So no one can change its programming or results. The machines run on batteries. This is because power supply can be irregular in places. The machine has two parts. One is the Control unit. The other is the Ballot unit. The Control Unit stores all data. It also controls how the EVM works. The program that controls it is put into a microchip. This can only be done once.

Once the program is put in it cannot be read, copied or changed. The EVM uses a code. This keeps data safe when it

is sent from the Ballot unit to the Control unit. New EVMs have a clock and date-time stamp. This shows the time and date when a key is pressed.

When voting is over and the close button is pressed the machine stops working. It does not accept any data or votes. The control unit can show the number of votes recorded. This can be checked with the voter register. The display shows votes polled in a station. It also shows votes for each candidate. This happens when the 'result' button is pressed. The control unit can also detect if someone tries to tamper with the cable. It shows this on the display. In the past elections in India used a lot of paper. 8,000 Tonnes of paper was used. 400,000 Phials of ink were used. 2.5 Million strongboxes were needed. The votes were kept safe until they were counted.

It took three to four days to count votes. People were hired to count each ballot. Sometimes people asked for a recount. This was because the difference, between the two candidates was small. There were also invalid votes.

II. LITERATURE REVIEW

A. *The Mandate and Context for Remote Voting*

The genesis of the RVM initiative lies in the recognition that internal migration is a significant driver of democratic exclusion. The project was inspired by Chief Election Commissioner Shri Kumar's direct observation of domestic migration challenges, leading to a focused effort on enabling migrant voters to cast their ballots from their current place of residence.

The magnitude of the problem is substantial, as an estimated 300 million non-voters were recorded in the 2019 General Elections. For migrant laborers, the inability to vote is directly tied to job loss and incurring high expenses for travel, often making the exercise of their democratic right economically prohibitive. The RVM prototype is designed explicitly to eliminate this migration-based disenfranchisement. While internal migration is complex, data shows that approximately 85% of movement is within states. Therefore, the RVM's primary operational impact will be facilitating intra-state remote voting, though its ability to address inter-state movement is equally critical.

B. *RVM Technology and Operational Framework*

The technological core of the new proposal is the Multi-Constituency Remote Electronic Voting Machine prototype. The pivotal feature enabling remote voting is the machine's capacity to host and manage ballot papers for multiple constituencies simultaneously from a single remote polling station.

Critically, the ECI has stipulated that the Multi-Constituency RVM will adhere to the existing EVM security protocol, maintaining the same security system and voter experience. This confirms that the RVM is fundamentally a DRE system operating in a remote physical location, rather than a departure toward Internet Voting. The ECI views this consistency as paramount to minimizing cyber security risk.

However, the remote deployment of this hardware necessitates overcoming massive administrative and logistical hurdles. The ECI formally sought input from political parties on these very challenges, encompassing legal, operational, administrative, and technological domains. Foremost among the administrative difficulties is the current absence of a centralized national database for internal migration, which is essential for accurate enrollment and verification. Furthermore, implementing RVM across states requires establishing robust procedures for voter portability—confirming the migrant voter's registration status—and ensuring unicity, or the prevention of double-voting across their remote and home constituencies. The sheer logistical coordination required to set up these new remote polling stations, equip them, and deploy staff across the country rivals

the existing challenge of managing over a million conventional polling stations.

C. *Legal and Statutory Interventions Required*

The transition to remote voting cannot be achieved without significant legislative action. Remote voting fundamentally alters the mechanism of vote casting, thereby requiring comprehensive amendments to India's core electoral statutes. These necessary legislative interventions include updating the Representation of People's Act of 1950 and 1951, the Conduct of Election Rules, 1961, and the Registration of Electors Rules, 1960. Historically, the Supreme Court has ruled that introducing new voting methods without explicit statutory backing is unconstitutional.⁵

Beyond the RVM, general discussions regarding modernizing access underscore the political imperative for change. Separately, efforts have been initiated to ensure voting rights for Non-Resident Indians (NRIs), which involves legislative changes (such as the proposed amendment to the Representation of the People Act, 1950) to allow them to vote at the nearest Indian diplomatic mission abroad.

At the local level, the Bihar State Election Commission's pilot e-voting for urban polls, using Android-based mobile apps for specific demographics (migrants, disabled, senior citizens), demonstrated that e-voting mechanisms raise fundamental constitutional questions regarding digital rights, electoral integrity, and the division of electoral authority in India's asymmetrical federal structure.

D. *Political and Public Reception*

The RVM concept has faced significant political headwinds. The ECI invited national and state political parties for a demonstration of the prototype in early 2023. Following this, opposition was quick and vocal; most opposition parties publicly decided to oppose the proposal in its current form. During subsequent discussions, opposition parties "grilled" ECI officials, arguing that the remote voting proposal could potentially jeopardize free and fair elections.

Broader civil society also expresses deep reservations about the increasing role of technology in electoral processes. Concerns extend beyond the RVM itself, focusing on the integrity risks posed by unregulated digital campaigning, the use of generative AI technologies (such as deepfakes) to influence voter perception, and the perceived inadequacies of voluntary, non-binding codes of ethics for digital platforms. These concerns indicate a pervasive environment of low institutional trust surrounding technology-driven electoral reforms.

The RVM proposal implicitly forces the ECI to solve its biggest administrative hurdle—data management—in order to safeguard its most cherished security feature—the air-gap. The RVM's reliance on isolated hardware (DRE) for security means its operational success depends entirely on the instantaneous verification of a voter's eligibility and constituency against a centralized database to prevent fraud (unicity). The ECI must therefore devise an unprecedentedly secure and real-time mechanism to track migrant voters across

constituencies. If this centralized data system is not flawlessly implemented, the ECI will be forced to accept a staggering logistical burden involving the physical distribution and constant secure updating of highly complex multi-constituency RVM hardware. Political opposition accurately perceives that the successful deployment of the RVM hinges less on the security of the machine itself and more on securing a vast, decentralized administrative process across state lines.

The necessity for India to address a large societal deficit—migrant disenfranchisement—using a conservative technological solution creates a high-risk operational hybrid. The primary goal of enabling social inclusion while adhering to a strict air-gapped security doctrine means the ECI faces a massive logistical and administrative challenge. The decision to retain DRE technology for remote, multi-constituency use introduces monumental complexities regarding identity verification, double-voting prevention, and securing widely dispersed hardware, burdens that are often addressed in I-voting systems through cryptography. This structural tension between security doctrine and operational complexity has already led to political pushback and opposition from various parties.

III. ANALYSIS OF EXISTING METHODOLOGIES

The analysis confirms that the RVM is a necessary evolution to ensure democratic inclusivity for India's massive domestic migrant population. However, its implementation must navigate a hybrid security environment that retains physical security benefits while simultaneously introducing unprecedented administrative challenges. Success depends less on the RVM hardware and more on achieving robust public and political transparency.

A. Achieving Political and Public Consensus for RVM

The ECI must adopt a strategy that proactively addresses the prevailing security concerns and political skepticism. This necessitates moving away from historical assertions of machine "infallibility".

Mandatory Adoption of Procedural Transparency: To secure political acceptance for RVM integrity, the ECI should immediately implement procedural auditing mechanisms mirrored by Brazil's success. This involves mandatory, public, multi-stakeholder review of the RVM source code and organizing competitive "Public Safety Tests" well in advance of any pilot deployment. This step would allow external experts and political parties to verify the accuracy of the multi-constituency logic.

Independent Technical Certification: Before piloting, the ECI should commission a rigorous, non-partisan security audit of the RVM prototype by recognized international researchers and cybersecurity experts. This independent review must specifically focus on how the multi-constituency DRE system manages internal data, secures the switch between ballots, and prevents insider manipulation across remote sites, ensuring all identified vulnerabilities are transparently disclosed and mitigated.

B. Legislative and Judicial Clarity

The legal foundation for remote voting must be secured prior to operational rollout to prevent future constitutional challenges.

Prioritizing Comprehensive Statutory Changes: Immediate legislative effort is essential to pass necessary amendments to the Representation of the People Acts (1950 and 1951) and the Conduct of Election Rules (1961), providing clear constitutional and legal authority for remote electronic voting.

Defining Voter Portability and Unicity: The legal framework must strictly define the protocols for managing the migrant voter registry and instantaneously marking a voter's record as utilized (unicity) to prevent cross-constituency double-voting. This requires precise regulatory guidelines under the Registration of Electors Rules, 1960.

Establishing Coercion-Resistance Protocol: New electoral rules must detail rigorous physical security and procedural measures required in temporary RVM polling booths to guarantee ballot secrecy and resistance to coercion, acknowledging that these remote locations inherently present greater monitoring challenges than fixed polling stations.

C. Implementation Road Map (Pilot Programs and Scalability)

The transition to RVM must be incremental and strategic, leveraging the data on internal migration patterns.

Targeted Pilot Design: Initial RVM deployment should focus on controlled, structured pilot programs concentrated in areas experiencing high rates of intra-state migration, which accounts for approximately 85% of domestic movement. This phased approach allows the ECI to refine logistics and voter verification processes before tackling the far greater complexity of inter-state remote voting.

Cost and Economic Impact Assessment: A detailed financial model is required to quantify the substantial logistical costs associated with RVM deployment (personnel, security, and infrastructure) and compare them with the projected long-term economic benefits derived from improved voter turnout and reduced economic burdens on the migrant workforce.

Secure Identity Verification Integration: To solve the critical issues of voter portability and preventing double-voting, the ECI should explore the secure utilization of existing identification platforms (such as Aadhaar, as suggested for general e-voting reform). This integration must be strictly limited to voter authentication and verification, ensuring that the air-gapped security principle of the RVM hardware, where the vote is cast, remains intact and separated from the network verification mechanism.

D. Long-term Strategy for Digital Governance

Given the global trend of disinformation targeting electoral integrity and the specific domestic concerns regarding the misuse of deepfakes and generative AI in

political narratives, the ECI must view RVM adoption as part of a broader strategy for maintaining trust in digital democracy.

Aggressive Communication Strategy: A transparent and robust public communication plan is required, directly linking the outcomes of independent RVM audits and procedural transparency measures to enhanced electoral integrity. This communication must directly counter disinformation campaigns aimed at undermining confidence in vote counting.

Policy for External Voting: While the RVM addresses domestic migrants, the ECI should maintain a separate, long-term policy track for external voters (Non-Resident Indians). This segment of the population, operating under different legal and security environments, may serve as a suitable cohort for piloting advanced, cryptographically verifiable Internet Voting (I-voting) solutions, acknowledging the convenience benefits demonstrated by countries like Ecuador for external voters.

IV. CONCLUSION

The pursuit of an inclusive democratic process in India necessitates a transition that bridges the gap between traditional physical voting and modern technological requirements. As explored in this study, the implementation of the Remote Electronic Voting Machine (RVM) represents a critical, albeit complex, evolution in the Election Commission of India's (ECI) efforts to mitigate migration-based disenfranchisement. While the RVM initiative aims to preserve the established security of air-gapped, Direct-Recording Electronic (DRE) systems, it introduces significant logistical and administrative challenges that require careful navigation.

In summary, the RVM is a high-risk, high-reward initiative. It occupies a structural tension between the need for social inclusion and the strict requirements of India's security doctrine. By integrating rigorous technical safeguards with a commitment to transparency and legislative clarity, India can leverage this technological evolution to strengthen its democratic foundation, ensuring that the right to vote is accessible to all citizens, regardless of their geographical movement.

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