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FUID SEVM FINGERPRINT UNIQUE ID SMART ELECTRONIC VOTING MACHINE

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Abstract: ***Traditional EVM is a robust device used for casting votes. Due to its stand-alone working nature, it cannot be hacked. But it doesn't content voter data due to which duplication of votes become serious concern. A manual checking of voter information is required to do by poling officer and their assistants which can cause error. A person can re-register his/her name in voting list from different state of India (if they migrated) without noticing to domicile state to remove names from previous voting lists. This cause voter duplication. Various studies on voting have been conducted which focuses more on online voting those cannot be trusted 100 percent. So, we developed a more secure and simple solution that can be integrated with traditional EVM to prevent duplication i.e., Bogus Voting. With the help of voter database, we are able to achieve accurate results on producing 100 percent accurate election results on small scale and can be scale up at larger level. The FUID SVEM lives to the fundamental principal of democracy that is 'One Voter One Vote' for Lok Sabha (Lower House of People) and Vidhan Sabha (Legislative Assembly) on two parameters which is Fingerprint and Unique ID. Digital verification of voter avoids error and only authentic voter gets verified and can cast his/her vote. All above mentioned things can be achieved only if accurate voter data is registered in centralized database and later distributed according to constituency to maintain proper stress of work force and EVM. This revolution will not just remove duplicate voters but also reduce election time and save cost with 100 percent accurate results.***

Keywords: *FUID, SEVM, PO, VC, VSDU.*

I. INTRODUCTION

Voting is a fundamental right of every Indian citizen given by the constitution of India (CoI). After Independence India held its first ever general election in the year 1951. It is believed that 173, 212, 343 voters were registered. More than 380, 000 reams of paper were used for printing the ballot papers. The elections were held in 68 phases throughout the nation. The Election Commission of India was setup to discuss, how the elections in India can be more secure and smooth. In 1982, Kerala become the first state to use Electronic Voting Machine (EVM) in its legislative assembly election. Years passed the Election Commission of India (ECI) did more advancements to the EVM by introducing the Voter-verified paper audit trail (VVPAT) in support to EVM. [13] The EVM is considered to the most robust Voting Machine which is made in India. Many people have questioned about its authenticity but were unable to prove it wrong in front of Government of India (GoI) and Supreme Court (SC).

The EVM is divided into two parts Presiding Officer (PO) and Voting Compartment (VC) and each contains various modules. PO Module contains VVPAT Status Display Unit (VSDU), and Control Unit (CU). VC Module contains Voter-verified paper audit trail (VVPAT), and Ballot Unit (BU). [5][11][13] An encrypted communication between CU, VVPAT, and BU happens. This mechanism is secure but is unable to identify duplicate voters who had already casted the vote. Except EVM which is a machine use for casting votes, manual work to check the information of voters before allowing them to vote is needed which sometimes can cause errors and due to this the

traditional EVM is unable to protect the fundamental principal of democracy that is 'One Voter One Vote', this term means that everyone's vote is treated equally regardless of their gender, caste and wealth.

Various discussions and studies in India and in various countries have been conducted how voting can be improved and made more secure. The world is in digital transformation phase, so many thoughts have come up that voting should also become digital. But making it digital might increase the chance of hacking and manipulating system. Studying history and analyzing problems, we have come up with a unique but simple solution for EVM which protects the fundamental principal of democracy that is 'One Voter One Vote' along with this it also saves resources used by government and makes the process more authentic. To demonstrate we have developed a hardware model which is named as 'Fingerprint Unique ID Smart Electronic Voting Machine' (FUID SEVM).

II. MOTIVATION

Being an Indian, I was always curious to learn how our previous and present sitting governments where and are able handle such huge nation and specifically Elections. In 1947, India's population count was just 34 crores, today it is above 135 crores. India being a democratic country, everyone is guaranteed their rights according to ***Part III*** *Fundamental Right* [12] and ***Part XV*** *Elections* [12] mentioned in The Constitution of India. Studying Traditional Elections and Laws written in constitution of India and considering todays digital era, online voting has been an area of research. Use of blockchain to make secure online voting is another widely discuss topic. Researchers says this technology will produce high quality and precise results. Considering the Ethos and the traditional methods we have developed a modern way to vote without losing original identify of EVM.

III. OBJECTIVE

- Follow fundamental principal of democracy that is 'One Voter One Vote'.
- To develop robust ecosystem for SEVM modules to satisfy objective 1.
- Create voters database with accurate information.
- Achieve zero duplication of voters to satisfy objective 3.
- Easy to understand by voters and officers to cast vote and to operate machine.

IV. EXISTING SYSTEM

According to our research the existing EVM lacks voter data which further leads to duplication of votes. As the EVM doesn't know the voter and has he/she voted once, twice or more. Voter is verified by searching their name in voting list which is a printed paper list. Such list may have duplicate entries and errors. Manual work increases the chances of vote duplication or misconduct in procedure. This not only require huge workforce but also requires high expenditure this may lead to corruption. The EVM doesn't have any Voter data so VVPAT machine is required to reverify the casted vote through a printed paper slip. If any question is raised upon the EVM the paper slips are counted to reverify casted votes are same or not this increases cost and require more time. Generally, this whole process takes 50 days approximately to complete from Candidates form filling, promotions, election day, results, etc.

Fig 1: Control Unit, VVPAT Unit, Ballot Unit [5]

V. LITERATURE SURVEY

In our research, we found out that the first research paper focused on the following things that says, With the emergence of COVID-19 as a global pandemic, the need for an online voting system became evident in India. India's electoral system left much to be desired. From ballot-stuffing to EVM hacking and from election tampering to polling booth capturing, various problems tended to plague the voting process in our country. Many countries were experimenting with blockchain-based voting machines at that time. The system preserved voters' anonymity while still being open to publish inspection. The voter was authenticated using a voter ID, Aadhaar card, and facial recognition. The voter could also assure that their cast was stored in a highly encrypted unique ID generated by our system, and the data was stored in a highly secured database.[1]

Second paper explain that, India, with its democratic form of government, had traditionally used voting machines to conduct elections. This was a costly procedure that was also highly labour-intensive. However, recent developments have resulted in the introduction of an online voting system which makes it

possible for citizens to vote from any location on the planet. In order to secure voting process, the Election Commission will take each voter's fingerprint and face image and store them in a database. On voting day, their data will be checked against the records in the database - making sure that any fraudulent activity is identified and prevented. Utilizing facial recognition technology and fingerprint scanners, the number of fraudulent voters can be significantly diminished in a timely manner.[2]

The third paper says that, India was the largest democratic country in the world. Therefore, it was essential to ensure that the governing body was elected through a fair election. India had only an offline voting system, which was not effective and up to the mark as it required a large workforce, and it also took more time to process and publish the results. Therefore, the system needed a change that would overcome these disadvantages. The project allowed the user to vote offline as well if he/she felt it was comfortable. The face scanning was useful at the time of voting. The offline voting system was improved with the help of RFID tags instead of a voter ID.[3]

VI. PROBLEM DEFINITION

Electronic voting has been an area of research for many years by using computing machines and equipment for casting votes and producing high quality and precise results in accordance with the sentiments of the participating voters. Initially ECI allowed the voter to cast their vote on papers. Nowadays ECI has shifted from papers to EVM's which allows a safe solution for elections. Our goal is to develop a smart solution for EVM to make it more smart by implementing voter authentication on 2 factors *i.e., fingerprint and barcode* and eliminate duplication of voter and preserve their valuable votes. It is an approach to stop misconduct while electoral procedure. If the voting system is well understood by the voters, the system's usability can be increased remarkably.

VII. SYSTEM ARCHITECTURE

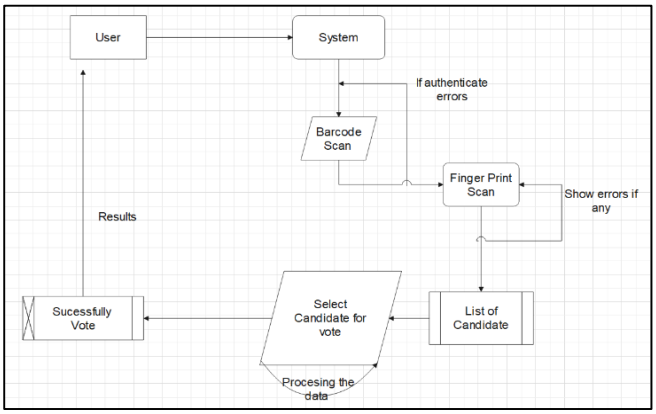

Fig 2: System Architecture of FUID SEVM

To cast vote the voter needs to follow certain steps and while casting vote main fundamental principal of democracy is 'One Voter One Vote' should be followed. Sticking to the fundamental principal a set of procedure are followed to make an accurate database of voters and candidate, here is the list:

A) Voter Registration: A voter is uniquely represented in database through his/her Unique ID [6] *i.e., barcode*, Fingerprint [7], which are their main authentication points and other details like Name, address, category, gender, etc are taken and stored in centralized database.

B) Candidate Registration: A candidate represents a party from which he/she is standing for election their data must contain Unique ID [6], candidate name, party name, etc.

C) Admin Details: Only the authorized person can access SEVM's access door by entering pin code.

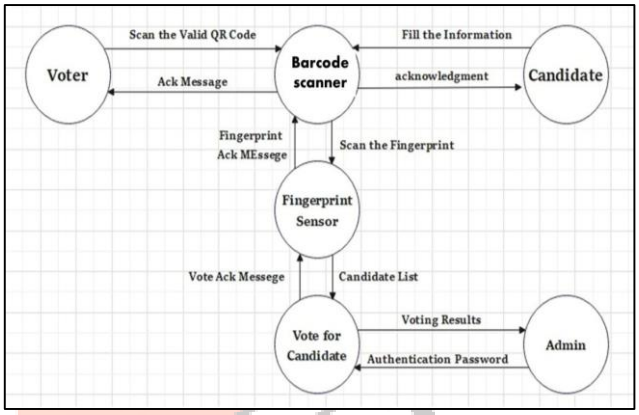

Fig 3: DFD for Voter, Candidate, and Admin

It is important that a voter must pass all verification parameter to cast vote, and system must be robust enough to not consider voter who had casted vote in their previous attempt.

Steps for voter to cast vote:

1) Voter should scan their barcode present on card. Once the barcode is correctly scanned SEVM beeps and it displays next step.

2) If the barcode is accepted it means voter is verified on first parameter and can go for next stage.

3) After barcode, SEVM prompts voter to scan fingerprint. Once the fingerprint is correctly scanned SEVM beeps and it displays next step.

4) If the fingerprint is accepted it means voter is verified on second parameter and now is fully authenticated through SEVM.

5) Once two factor authentication is done the display give prompt of candidate to whom voter will cast his/her vote.

6) Once he/she cast their vote by pressing the button SEVM beeps and resets itself for new vote to be casted.

7) This process continues until all voters have casted their votes onto the designated SEVM only.
8) If a voter who has voted earlier tries to give vote once again, he/she will be require to repeat the authentication process again.
9) But as our fundamental principal states 'One Voter One Vote', it will not accept the same voter again though he/she tries to scan it again and again.

Steps for admin to access storage:

1) To access the storage admin is provided a pass code which need to enter on keypad present on backside of SEVM.
2) This pass code give access to storage module which stores the election results.

VIII. IMPLEMENTATION

Every voter's data is stored in centralized database which include his/her details this helps use create huge database of voters that represents each uniquely.

- Just like Aadhaar Card registration, here Voter needs to do registration which include their details and fingerprint. [6][7]
- The sensor captures the image of fingertips and provide it a unique ID. After fingerprint the system generates a unique barcode which is assigned to the voter and its fingerprint.
- This linking of fingerprint and unique barcode allows voter to be unique which cannot be duplicated by the system.
- This prevents voter to re-register themselves from a different state, if they tried to do so their records present in centralized database prevents this duplication based on parameters *i.e., fingerprint*.

As we know traditional election committee divides list of voters according to constituency similarly our systems divide voters' data and as the data is stored in digital form voter can directly scan their barcode to verify themselves in Phase 1-Voter Verification (VV) and can then procced to Phase 2-Casting of Vote (CoV).

IX. PROPOSED MODEL DESIGN AND DISMENSIONS

Designing is an important part of any project. Starting from idea and sketching it on paper gives a basic idea about the model. To get a brief understanding, our design team created a 2D image and isometric view using Microsoft power point software. The 2D image give us an idea to visualize 3D model.

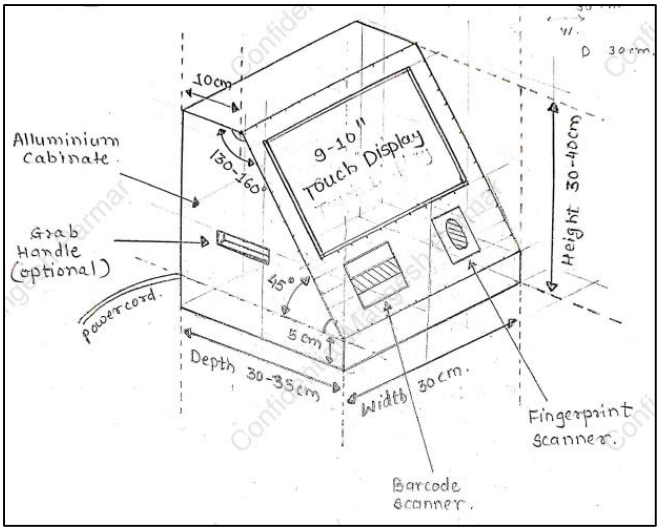

Fig 4: Initial Visualization of Model through sketch.

Microsoft power point was use in second phase of model design where we created a 2D image to better understand. After purchasing the required components like display, buttons, keypad, servo, fingerprint, etc. dimensions of each component were measure phase 3. *i.e., 3D modeling using Creo 5.0 parametric software.*

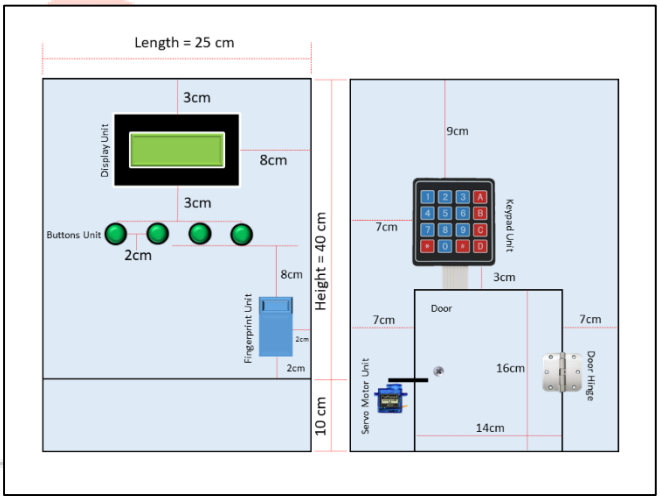

Fig 5: 2D Image of Front and Back with Dimensions

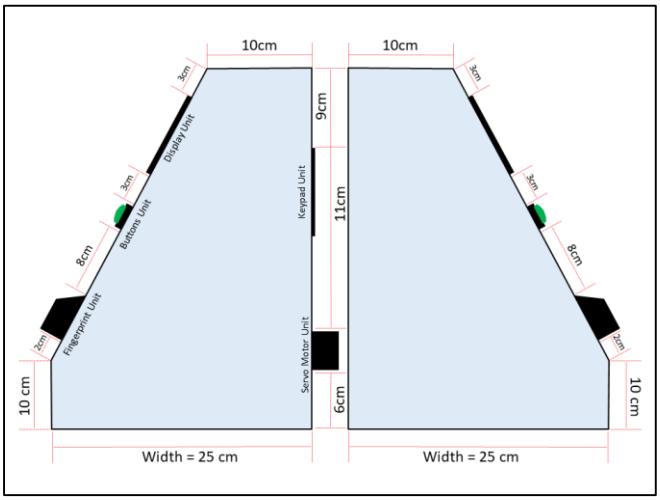

Fig 6: 2D Image of Sides (L&R) with Dimensions

With proper measurement shown in Fig 5 and Fig 6, we can now start phase 3 of model design. Taking dimensions reduced our work load for 3D modeling.

A visualization of ATM machine was kept in mind while designing the SEVM. Many of us use ATM on regular basis and we know that how easy it is to use. Similarly, our plan is to build a smart but easy to use voting machine.

The model dimensions are as follows:

- Height: 40 cm
- Width: 25 cm
- Length: 25 cm

**These dimensions represent the basic block measurements for our project.*

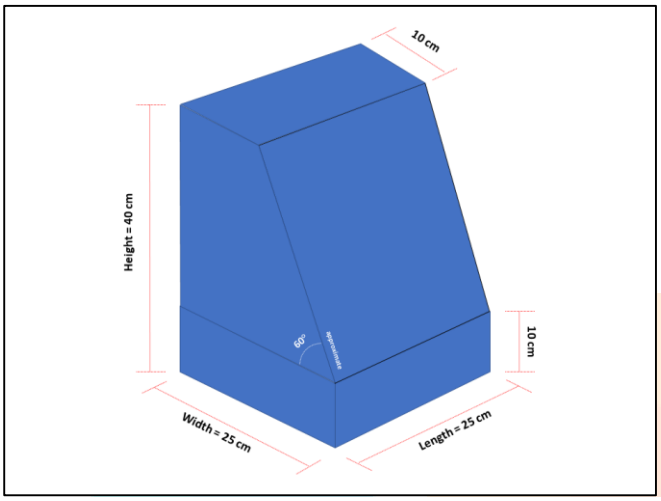

Fig 7: Isometric Projection Designed in PowerPoint

The isometric view is necessary in our project for a comprehensive understanding of the Smart Electronic Voting Machine's design and spatial relationships.

3D model using Creo 5.0 Parametric Student Edition Software:

The Creo 5.0 Parametric Student Edition software was used to create 3D model of project. This software provided us with the necessary tools and capabilities to bring our design to life in a three-dimensional format.

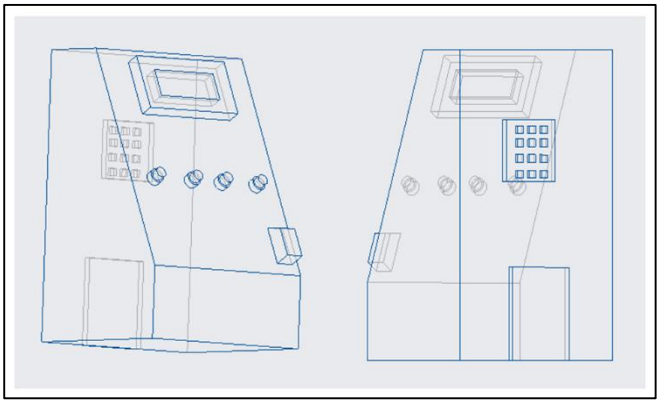

Fig 8: Wireframe Design in Creo 5.0

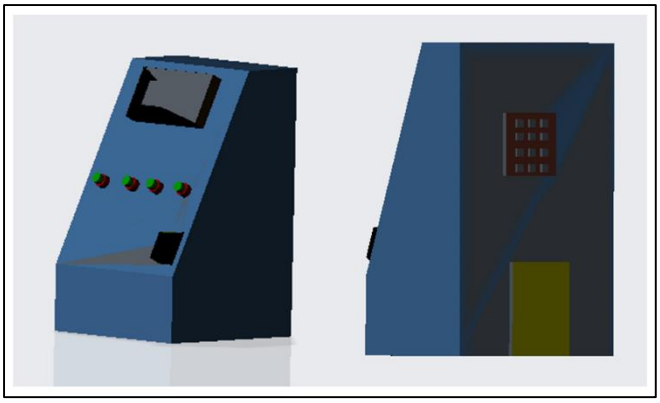

Fig 9: The Rendered Model in Creo 5.0 Parametric

The wireframe view simplifies the structure and reveals the underlying framework, aiding comprehension of the 2D design for our project, the Smart Electronic Voting Machine. This visualization of component arrangement and connectivity allows for a seamless translation into a comprehensive 3D model, enhancing our understanding of the rendered representation of our project.

Fig 10: Actual Size Model of SEVM

Systemic work produces accurate outputs. The results include Fig 10, which represents an actual-size model. Utilizing paper sketches, 2D modeling with PowerPoint, and 3D modeling in Creo 5.0 Parametric software, we explore new possibilities in design. We gain proficiency not only in visualization but also in handling software across diverse domains, such as Creo 5.0 Parametric software.

X. SOFTWARE IMPLEMENTATION

The crucial role of software in developing hardware cannot be overstated. Through programming with Python and utilizing the Arduino Mega, we were able to bring our model to life, achieving our goals with resounding success.

The Syno demo Fingerprint Software proved invaluable as it facilitated the storage of fingerprints in image format, with each fingerprint assigned a unique number. This unique number served as a crucial identifier for each voter, ensuring accurate authentication.

The Arduino IDE played a vital role by enabling us to program a set of code that established seamless communication among the components within our SEVM. We utilized an Arduino Mega board, ensuring that it met the minimum requirements necessary to accomplish the objectives of our project.

Additionally, the Barcode Generator software was used in phase 1 voter verification. It converted the unique identification numbers assigned to each voter into scannable barcodes. This step was important for voter verification process for every voter.

By harnessing the power of these software tools, we not only achieved successful hardware development but also enhanced the overall functionality, security, and reliability of our SEVM.

XI. PROPOSED TEST RESULTS AND ANALYSIS

Testing helps us identify and resolve system flaws, ensuring accurate results. To uphold the fundamental principle of democracy, "One Voter One Vote," the machine must pass the following test cases:

Some test cases designed for SEVM testing:

1. Voter first authentication by barcode.
2. Voter second authentication by fingerprint.
3. Casting of votes by pressing button.
4. Resetting of SEVM once vote is done.
5. Do not accept voter who already casted vote.
6. Only admin can access the SEVM by pass code.
7. Removal of Storage device makes SEVM useless.

Results compared with existing system:

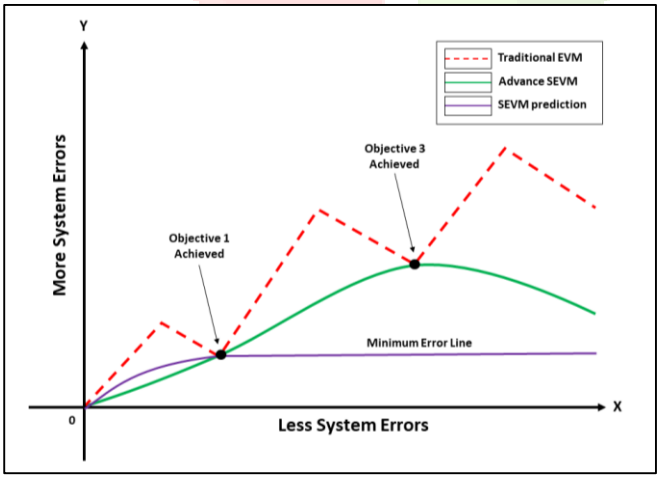

Fig 11: Error comparison of EVM & SEVM

In Figure 7, the objectives and flaws of the Traditional EVM (red dashed line) leading to voter duplication are depicted. The Advanced SEVM (green line) resolves these issues by incorporating the FUID technique. The predictions and improvements showcased in the figure highlight the emphasis on result visualization and accuracy of the SEVM (violet line).

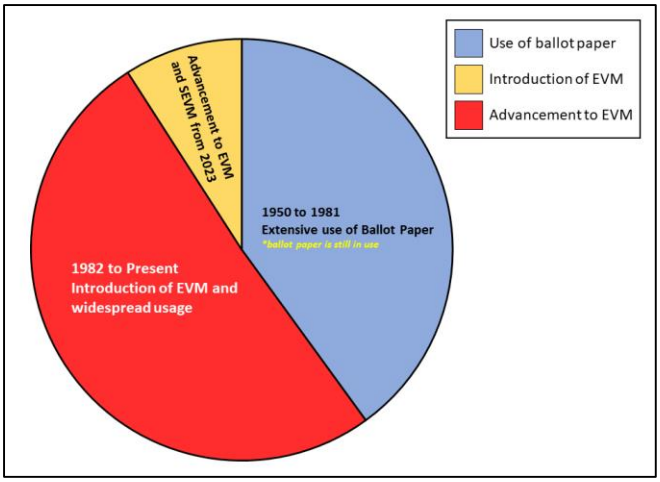

Fig 12: Use of ballot paper and EVM credibility

XII. APPLICATIONS

Electronic Voting Machines (EVMs) are purpose-built for elections and hold immense significance in a nation's electoral process. Safeguarding voter anonymity is paramount to protect lives, and the proper utilization of EVMs contributes to the establishment of a genuine government. Smart Electronic Voting Machines (SEVMs) transcend beyond central and state governments, facilitating elections in diverse organizations and institutes that have governing bodies. These include hospitals, banks, theater and movie associations, educational institutes, unions, councils, and more.

SEVMs offer benefits even to small organizations or institutes with a maximum capacity of 1000 people. By utilizing SEVMs, they can achieve substantial time and cost savings while ensuring impeccable accuracy of results, reaching a remarkable 100 percent. Our project's primary goal, 'One Voter One Vote,' is effectively realized through the implementation of our SEVM. It can be employed as phase 1: Voter Verification alongside traditional EVM setups, guaranteeing the attainment of completely fair voting outcomes. The SEVM technology enables us to advance the principles of democracy and contribute to the democratic fabric of our nation.

XIII. CONCLUSION AND FUTURE ADVANCEMENT

While it is often beneficial to maintain certain aspects in their original form, embracing advancements is always encouraged. This holds true for the elections in India, which can be likened to a festival—a celebration of public participation. During this festival, every Indian citizen exercises their vital democratic right: the right to vote. Through our diligent research, we successfully implemented the fundamental principle of democracy, "One Voter One Vote," by developing the Fingerprint Unique ID Smart Electronic Voting

Machine. This advancement in the EVM setup contributes to India's journey towards becoming a more democratic nation.

The SEVM project has a future roadmap that includes several advancements. These advancements will enable the display of exit polls, hourly data, and constituency-based data generated through big data analytics and visualization techniques.

Additionally, more robust encryption algorithms will be implemented to ensure voters' anonymity and administrative protection for the SEVM. Moreover, a key focus will be on minimizing the setup required for the EVM, streamlining the voting process for increased efficiency and convenience.

XIV. ACKNOWLEDGMENT

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5. Mr. G. N. Lohar (Electoral Procedure Guide)
6. Mr. S. M. Pawar (Electoral Procedure Guide)
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8. Mr. S. B. Parmar (General Advisor)
9. Mr. N. R. Khairnar (General Advisor)
10. Mr. V. B. Lohar (EVM Operation Facilitator)
11. Mr. M. H. Kafare (EVM Operation Facilitator)
12. Mr. A. D. Sonawane (IoT Expert)
13. Miss S. S. Pande (Documentation Advisor)
14. Mr. S. G. Kanjarej (Software Guide)
15. Mr. G. S. Patil (Management)
16. Mr. T. S. Shrigondekar (Management)

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XVI. BIBLOGRAPHY

1. FUID: Fingerprint Unique ID
2. SEVM: Smart Electronic Voting Machine
3. PO: Presiding Officer
4. VC: Voting Compartment
5. VSDU: VVPAT Status Display Unit
6. EVM: Electronic Voting Machine
7. ECI: Election Commission of India
8. VVPAT: Voter Verified Paper Audit Trail
9. CoI: Constitution of India
10. GoI: Government of India
11. SC: Supreme Court
12. CU: Control Unit

13. BU: Ballot Unit
14. ID: Identity Document
15. RFID: Radio Frequency Identification
16. VV: Voter Verification
17. CoV: Casting of Votes
18. ATM: Automated Teller Machine
19. 2D: Two Dimensional
20. 3D: Three Dimensional