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RFID Based Electronic Voting Machine Using Microcontroller

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Abstract - *Electronic Voting Machines (EVMs) have greatly transformed the voting process by providing efficiency, security, and reliability compared to paper-based systems. This paper discusses the incorporation of Radio Frequency Identification (RFID) authentication in EVMs to boost security, eradicate electoral fraud, and simplify the voting process. The system makes sure that only qualified voters can vote by applying RFID-based voter verification. The suggested system offers a safe and effective method for electronic voting while preserving the secrecy of the voters and authenticity.*

***KeyWords*: Electronic Voting Machine, RFID, Security, Prevention of Electoral Fraud.**

1.INTRODUCTION

Voting is a fundamental democratic process that enables citizens to elect their representatives. Traditional voting methods, such as paper ballots, have been prone to various forms of electoral fraud, including vote duplication, impersonation, and result manipulation. Electronic Voting Machines (EVMs) have emerged as a technological solution to address these challenges by digitizing the voting process and reducing human intervention.

To counteract these problems, contemporary voting systems utilize RFID mechanisms to ensure improved voter verification. RFID technology is employed for identifying voters by means of special identification cards scanning allows only the authentic voter to cast a vote.This authentication mechanism ensures greater security, avoids unauthorized voting, and upholds electoral integrity.

The suggested EVM is superior to traditional ones since it uses an RFID module and a better authentication system. It does not involve human mistakes in counting votes and shows the results directly on an LCD screen, minimizing controversy and increasing transparency.

2. PROPOSED SYSTEM

The system suggested improves voting efficiency and security through the use of RFID technology to authenticate voters. Every registered voter is issued an RFID card that is read by the EVM to confirm identity. After a successful authentication, the voter is prompted to enter a password (if necessary) and vote through a keypad. The system keeps votes safely in memory, such that every voter can only vote once.

A microcontroller controls the RFID reader, keypad, and LCD display to avoid manual mistakes and external interference. The last vote tally is shown on the LCD screen and can be saved in EEPROM for record purposes. The system also provides computer interfacing through RS232 for secure data transfer.

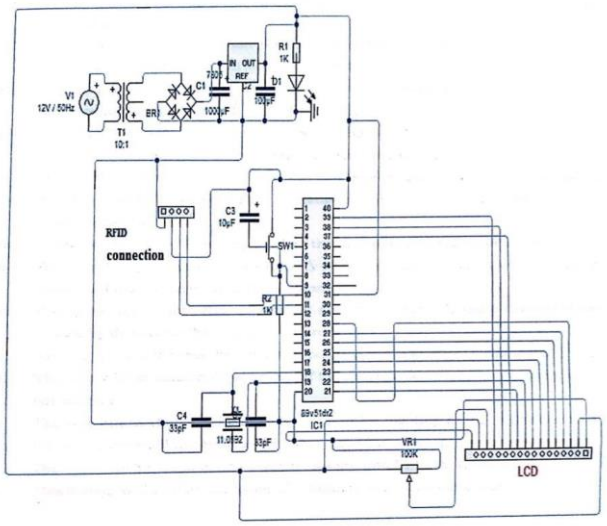

Fig.1: Circuit Diagram

This cost-cutting, tamper-evident EVM enhances accuracy, speed, and eliminates manual count of votes. Biometric login and wireless transfer of data might be future refinements for maximum security.

3. COMPONENTS:

3.1 SST89E516RD Microcontroller

The SST89E516RD-40-C-PIE is an SST's FlashFlex family 8-bit 8051-compatible microcontroller with 72 KB SuperFlash EEPROM (64 KB primary + 8 KB secondary) and 1 KB RAM. It runs at 0–40 MHz (5V) and has provision for up to 64 KB of external program and data memory. Key features are three 16-bit timers, improved UART, SPI interface, programmable watchdog timer, and several low-power modes. It also provides high-current drive ports, 10 interrupt sources, and in-application

programming (IAP) support. It is available in various package options, is RoHS-compliant, and supports industrial and commercial temperature ranges.

3.2 RFID Module

The EM-18 RFID Reader Module is a 125 kHz RFID reader used for reading passive RFID tags and sending their 12-digit unique ID through UART (9600 bps) or Wiegand protocol. Powered by 5V DC with a reading range of 5–10 cm, it has a built-in antenna, buzzer, and LED indicators for instant feedback. The module is small, draws ~50 mA, and reacts in 200 ms. Used widely in access control, attendance systems, automated payment, and inventory control, the EM-18 is inexpensive, robust, and simple to integrate into security and authentication applications.

The system improves voting security and efficiency through the use of RFID technology for voter verification. A registered voter is issued a personalized RFID card, which is read by the EVM to confirm identity. The voter then authenticates with a password (if needed) and votes using a keypad. Votes are stored securely in memory to allow each voter to vote only once.

3.3 LCD Display (16x2 LCD)

The 16x2 LCD display is employed to display system messages, user prompts, and voting results. It can present two lines of text with 16 characters in each line and is ideal for applications that involve real-time visual feedback. The microcontroller will send commands to the LCD to refresh information accordingly.

3.4 RFID Cards

RFID cards hold specific identification information that the RFID reader reads. Every card has an RFID chip embedded into it that sends its ID when held near the reader. These cards assist in the authentication process, allowing only approved users to use the system.

3.5 Voltage Regulator IC

The 7805 and 7812 voltage regulator ICs give a stable power supply of 5V and 12V, respectively. They keep the voltage steady and make sure that all the components get the proper operating voltage, saving them from damage caused by power surges.

3.6 Transformer

The transformer reduces the 230V AC supply from the mains to a voltage lower than is required by the circuit. The high voltage AC is converted into lower voltage AC before it can be passed through a rectifier and voltage regulator to get a stable DC supply.

3.7 Crystal Oscillator

A crystal oscillator gives a stable clock signal to the microcontroller. It provides accurate timing and synchronization of operations in the system. The common frequencies employed in microcontroller circuits are 11.0592 MHz or 16 MHz.

3.8 MAX232 IC

MAX232 IC is employed for serial communication, where signals are converted between TTL (Transistor-Transistor Logic) and RS232 voltage levels. This allows the microcontroller to exchange information with external devices like a computer or another embedded system.

4 DESIGN AND DEVELOPMENT

The Electronic Voting Machine (EVM) is developed with the SST89E516RD microcontroller, supplemented by other components such as an LCD display, EEPROM, RFID module, push buttons, and a power supply module. The system architecture provides secure and efficient voting, avoiding duplicate votes and enabling rapid result retrieval.

The system comprises the following major components:

Microcontroller (SST89E516RD): Manages vote processing, storage, and system operations.

EEPROM: Continuously stores the vote counts even in the event of power loss.

LCD Display: Displays the voting status and results.

RFID Module: Provides security through voter identification verification prior to their voting.

Push Buttons: To cast votes, start the system, and for result display.

Power Supply: Supplies regulated 5V voltage to all circuits.

A block diagram representation schematically describes the flow of input (voter actions) to processing (microcontroller logic) and output (LCD display and result storage).

5 Working

The working of the EVM is a step-by-step process to make it reliable and accurate:

System Initialization: The control button is pressed by the polling officer to initialize the EVM. The LCD shows a voting ready message

Voter Authentication (RFID-based):

The voter swipes their RFID card for authentication.

If the card is authentic, the system permits voting; else it denies.

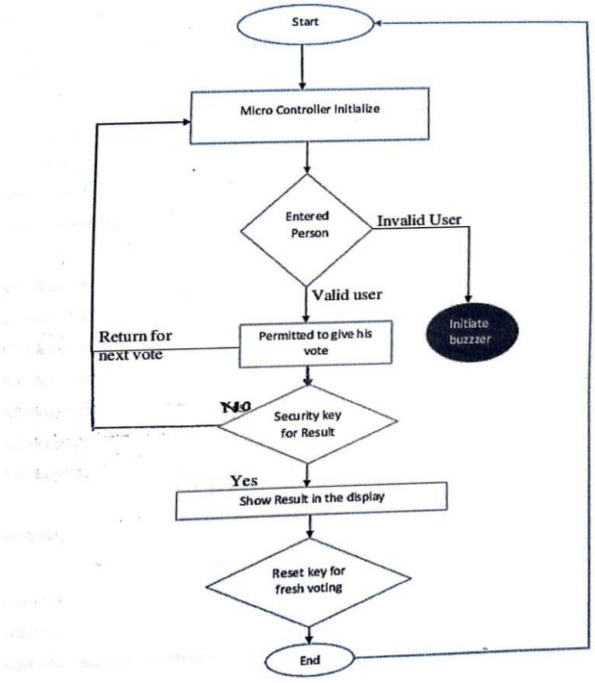

Fig.2: Flow Chart

Casting Votes:

A voter depresses the button of their chosen candidate.

The vote is registered and the EEPROM memory is updated.

The LCD displays the vote with a message.

Prevention of Multiple Voting: The system prevents a voter from casting multiple votes using RFID-based authentication and external interrupt facilities.

Result Display:

After completion of polling, the result button is pressed to display the counts of votes on the LCD screen.

Results can also be obtained through serial communication with a computer for further confirmation.

The firmware is written in embedded C, and the microcontroller logic provides error-free and smooth operation.

5. PROPOSED PROTOTYPE:

The suggested Electronic Voting Machine (EVM) prototype combinesRFID-basedauthenticationwith microcontroller-based recording of votes to provide security and efficiency. The system supports four candidates, and a vote can be cast by only authorized voters through an RFID card. The structure provides correct counting of votes, avoids double voting, and supports real-time result output**.**

5.1 Significant Functional Modules

ControlUnit(SST89E516RD Microcontroller):

Serves as the processing center.
Controls authentication, storing of votes, and LCD display.

Voting Unit:

Consists of RFID reader and push buttons to choose candidates.
Prevents multiple votes being registered by one authorized voter.

Display Unit (16x2 LCD):

Directs voters on how to vote.

Displays messages like "Please scan your card," "Vote cast successfully," and "Results displayed."

Power Supply Unit:

Delivers a 5V regulated DC power supply to the microcontroller, LCD, and RFID reader.

Data Storage Unit (EEPROM):

Stores vote counts permanently even in the event of a power failure.

Can be accessed through serial communication for result verification.

5.2. Operations of the Prototype

System Initialization:

The polling officer powers on the EVM.

LCD shows a "Ready to Vote" message.

Voter Authentication (RFID Verification):

The voter reads his RFID card.

In case of valid, voting is permitted; in case of invalid, access is withheld.

Voting Process:

The voter votes for a candidate by clicking the corresponding push button.

The system marks the vote and saves it in EEPROM.

LCD acknowledges the vote.

Preventing Multiple Voting

The RFID system prevents a voter from casting more than one vote.

Result Calculation and Display:

After the polling is complete, the officer clicks the Result Button.

The LCD shows the total vote for each candidate.

6. RESULTS

The Electronic Voting Machine (EVM) based on RFID was tested for security, accuracy, and efficiency. When the microcontroller is initialized, it boots up, showing "PLEASE SCAN YOUR CARD." The voters are authenticated by scanning an RFID card and entering a password. If it is invalid, voting is rejected. After authentication, they choose a candidate, and the system marks the vote, increments the count, and verifies with "VOTE SUCCESSFULLY CAST" and a buzzer.

To avoid double voting, the system identifies duplicate scanning of cards and shows "ALREADY VOTED." Counts are updated in real-time and are kept in EEPROM to keep data intact even after power failure. Once voting is complete, the results are shown on the LCD and can be printed out via RS232 for further evaluation. This guarantees safe, reliable, and accurate electronic voting.

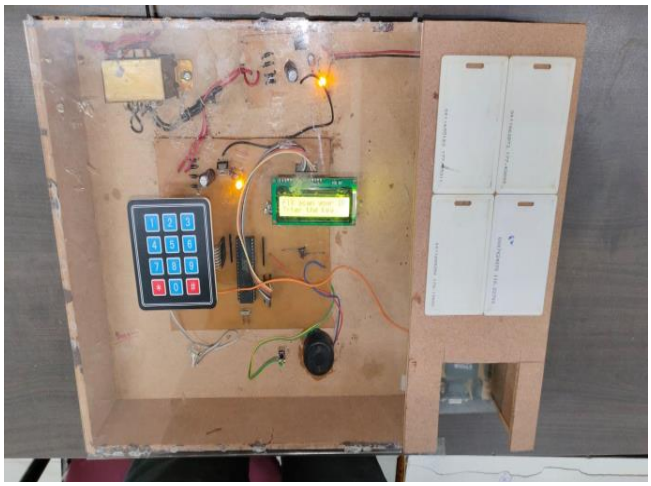

Fig.3: Prototype Design

7. CONCLUSION

The Electronic Voting Machine (EVM) based on RFID, designed in this project, efficiently proves a secure, efficient, and user-friendly method of electronic voting. Through the implementation of RFID technology and a microcontroller system, the machine accurately authenticates the voter, detects duplicate voting, and counts votes in real-time.

The most significant benefits of this system are:

Prevention of manual errors in vote counting.

Increased security through RFID authentication and password checks.

Faster processing of results, minimizing the time taken for vote counting.

Tamper-proof, ensuring unauthorized access or vote tampering.

Compact and economical, making it ideal for multiple election processes, such as student council elections, board elections for companies, and even political elections on a larger scale.

The project achieved its targets by developing an efficient and reliable voting system which can be extended with features like biometric authentication, internet-based data transmission, and a centralized election surveillance system.

The RFID-based EVM can provide a modern substitute to conventional ballot systems, providing an open, extensible, and efficient means of conducting elections in various fields.

8. FUTURE SCOPE

1.Biometric Authentication:

Adding fingerprint or facial recognition with RFID will add security and allow only enrolled voters to vote.

2.Integration with Government Databases:

Connecting the EVM with Aadhaar or national ID databases will eliminate multiple voting and facilitate smooth voter authentication.

3.Enhanced Data Storage & Security:

Using encryption and blockchain technology will protect vote records, guard against tampering, and provide permanent data storage for audits.

9. ACKNOWLEDGEMENT

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