International Journal of Scientific Research and Engineering Development-– Volume 7 Issue 3, May-June 2024
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

RFID Based Electronic Voting Machine Using OTP and BIO-Metric Verification

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Abstract:
The paper describes the implementation of an innovative Electronic Voting Machine (EVM) that integrates Radio Frequency Identification (RFID) technology, One-Time Password (OTP) authentication, and biometric verification to enhance the security and transparency of electionsThe integration of Radio Frequency Identification (RFID) technology, One-Time Password (OTP) authentication, and biometric verification in our Electronic Voting Machine (EVM) marks a significant leap forward in ensuring the security and transparency of electoral processes. With this innovative system, each voter is uniquely identified through RFID tags, thereby eliminating the possibility of duplicate voting. This foundational layer of security sets the stage for a robust and reliable voting environment.

Upon reaching the EVM, voters undergo biometric verification, typically through fingerprint scanning or other biometric data. This step adds an extra layer of authentication, ensuring that only legitimate voters can proceed to cast their ballots. By combining biometric verification with RFID technology, we further bolster the integrity of the electoral process, mitigating the risk of impersonation or unauthorized access.
Following successful biometric verification, voters receive a unique OTP via SMS to their registered mobile phone numbers. This OTP serves as a temporary authentication code, providing an additional checkpoint to confirm the identity of the voter before they can proceed to cast their vote. The use of OTP authentication adds another dimension of security, effectively safeguarding against unauthorized access and fraudulent activities.
The culmination of these multi-layered security measures significantly reduces the likelihood of fraud and ensures that only authorized individuals participate in the voting process. By synergizing RFID technology, OTP authentication, and biometric verification, our system offers a reliable, secure, and transparent method for conducting elections. This holistic approach not only enhances the integrity of electoral outcomes but also fosters public trust and confidence in the democratic process. Ultimately, our innovative EVM represents a pivotal step towards advancing electoral security and transparency in the digital age.

KEYWORDS: RFID, Bio-Metric Verification, OTP

I . INTRODUCTION

Our project addresses the shortcomings of traditional voting methods by introducing an innovative Electronic Voting Machine (EVM) fortified with Radio Frequency Identification (RFID) technology, One-Time Password (OTP) authentication, and biometric verification.

The amalgamation of these cutting-edge technologies aims to revolutionize the electoral process, ushering in a new era of heightened security, transparency, and efficiency. By uniquely identifying voters through RFID tags, our EVM eradicates the possibility of multiple voting instances, thus safeguarding the integrity of the electoral system. Additionally, biometric verification authenticates individuals based on their distinct physiological traits such as fingerprints or iris scans, further bolstering the authentication process.
The incorporation of OTP authentication introduces an additional layer of security, ensuring that only authorized voters can participate in the electoral process. This comprehensive approach not only fortifies the integrity of the voting process but also cultivates trust and confidence in the democratic system, thereby fostering fair and credible elections.

Our paper commences by delving into the current landscape of innovation, exploring the advancements in technology that have paved the way for our groundbreaking EVM. We then transition to elucidating the proposed design, providing a detailed breakdown of each module and elucidating the intricate workings of the system. Finally, we present the results of our research, furnishing comprehensive details and specifications of the components involved. This concept will be materialized as a prototype model, showcasing the practical implementation of our innovative electoral solution. Through this endeavour, we aspire to set a new standard for electoral integrity and transparency, ensuring that democratic principles are upheld in the digital age.

II . Overview of the project

Enhancing Security: Our foremost objective is to fortify the security of the voting process through the integration of multiple layers of verification, including RFID tags, one-time passwords (OTPs), and biometric authentication. This multi-faceted approach serves as a robust deterrent against unauthorized access, safeguarding the integrity of the entire voting system. By requiring individuals to undergo stringent verification steps, we significantly reduce the risk of fraudulent activities and unauthorized manipulation of the voting process.

Ensuring Accuracy: Leveraging advanced technologies such as RFID, OTPs, and biometric verification, our project is dedicated to minimizing the potential for fraudulent voting practices, such as impersonation or ballot tampering. Each voter's identity is meticulously verified through RFID tags and biometric data, ensuring that only legitimate voters can cast their ballots. This meticulous authentication process guarantees that each vote is accurately recorded and attributed to the rightful voter, thereby upholding the fundamental principles of fairness and accuracy in democratic elections.

Increasing Accessibility: In addition to enhancing security and accuracy, our project focuses on increasing the accessibility of the electoral process. By implementing biometric verification alongside RFID-based electronic voting machines, we strive to create a more inclusive voting environment. This inclusive approach enables individuals with disabilities or those without proper identification to participate in the electoral process securely and independently. By removing barriers to access, we ensure that every eligible voter can exercise their democratic right to vote, thereby promoting inclusivity and equality in the electoral process.

III. LITERATURE SURVEY

The literature review on RFID-based Electronic Voting Machines (EVMs) integrating one-time-password (OTP) and biometric verification reveals a rich and diverse landscape of research and development aimed at enhancing the security, efficiency, and reliability of electoral processes. Scholars and researchers have delved into various facets of these technologies, including system architecture, cryptographic protocols, usability, and voter authentication mechanisms.

Numerous studies have underscored the advantages of RFID technology in facilitating secure and tamper-resistant voter identification. By enabling each voter's unique identity to be authenticated through biometric verification, RFID-based EVMs minimize the risk of fraudulent activities, ensuring the integrity of the voting process.

The integration of OTP adds an extra layer of security by generating dynamic passwords for each voting transaction. This feature mitigates the threat of unauthorized access or manipulation, further enhancing the robustness of the electoral system.

Moreover, the literature emphasizes the importance of usability and accessibility, advocating for user-friendly interfaces and inclusive design principles to accommodate diverse voter demographics. By prioritizing ease of use and accessibility, researchers aim to ensure that all eligible voters can participate in the electoral process seamlessly.

Despite the promising advancements, challenges such as privacy concerns, technological constraints, and regulatory frameworks necessitate further investigation and collaboration across interdisciplinary domains. Researchers continue to explore innovative solutions to address these challenges and enhance the security and transparency of electoral processes.

In examining specific studies, the first paper introduces the Electronic Smart Voting System (ESVS) with biometric authentication and OTP verification. The system utilizes Aadhar numbers for voter identification, enhancing security and reliability. The second paper explores a Location-Free Voting System leveraging IoT technology, enabling voters to cast their ballots from any location securely. The third paper presents an Application for Online Voting System using Android devices, emphasizing high-level security and accessibility. Finally, the fourth paper discusses the Design of a Secured E-Voting System, focusing on addressing security concerns through RFID technology and government compliance.

Overall, the literature highlights the potential of RFID-based EVMs with OTP and biometric verification to strengthen the integrity and transparency of electoral processes, paving the way for more secure and democratic voting systems.

IV .EXISTINGSYSTEM

In existing papers, the integration of RFID-based electronic voting systems with OTP and biometric verification presents a sophisticated and multi-layered approach to securing and authenticating voters. RFID tags or cards play a crucial role in uniquely identifying individuals, serving as the initial step in the authentication process. The dynamic nature of OTPs adds an additional layer of security by generating unique authentication codes for each vote cast. This dynamic authentication mechanism helps prevent replay attacks and unauthorized access to the system, thereby bolstering the overall security posture.

Biometric verification further enhances the accuracy and reliability of voter authentication by validating the physical characteristics of the individual, such as fingerprints or iris scans. By incorporating biometric data, these systems ensure that the person attempting to cast a vote is indeed the rightful owner of the RFID tag or card, adding an extra layer of assurance to the authentication process.

The overarching goal of these systems is to mitigate fraud and unauthorized access, thereby safeguarding the integrity and confidentiality of the electoral process. By combining RFID technology, OTP authentication, and

biometric verification, researchers aim to create robust and trustworthy electronic voting systems capable of upholding the principles of democracy. These technologies work in tandem to provide a comprehensive and resilient security framework, ensuring that only authorized individuals are able to participate in the voting process and that each vote is accurately recorded and attributed to the rightful voter.

Overall, the integration of RFID, OTP, and biometric verification represents a significant advancement in electronic voting systems, offering enhanced security and authentication mechanisms that are crucial for maintaining the integrity and trustworthiness of democratic elections.

The Disadvantages of existing system

1.Security Concerns
2.Reliability and Accuracy
3.Accessibility
4.Transparency and Auditability
5.Cost and Maintenance

V. Proposed System

In the proposed system, in addition to the integration of RFID-based electronic voting systems with OTP and biometric verification, the Internet of Things (IoT) has been incorporated to enhance the functionality and efficiency of the electoral process. One key aspect where IoT contributes is in the management of the database. By leveraging IoT devices, the system can seamlessly collect, process, and store voter data in a centralized database, ensuring data integrity and accessibility.

Moreover, IoT facilitates real-time polling results with graphical representation, offering a significant improvement over traditional methods of vote counting. In the existing system, each individual voting machine's results must be manually tallied and consolidated, a process that can be time-consuming and prone to errors. However, with the proposed system, all voting system results are automatically uploaded to the cloud in real-time. This enables election officials and stakeholders to access up-to-date polling data instantly, allowing for faster decision-making and response to emerging trends.

The graphical representation of polling results provides a visual and intuitive way to analyze and interpret voting patterns, trends, and outcomes. This not only streamlines the process of monitoring the election progress but also enhances transparency and accountability by providing stakeholders with clear and comprehensible insights into the electoral process.

Overall, the integration of IoT into the RFID-based electronic voting systems with OTP and biometric verification offers a comprehensive and innovative solution for conducting secure, efficient, and transparent elections. By automating data collection, processing, and analysis, the proposed system not only reduces the burden on election officials but also enhances the overall integrity and credibility of the electoral process.

VI.Block Diagram

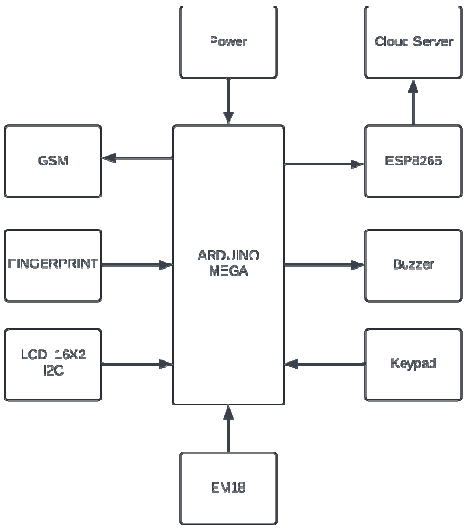

Fig.1 Block Diagram

The RFID-based Electronic Voting Machine (EVM) project integrates One-Time Password (OTP) and biometric verification to ensure secure and reliable voting. Voter ID cards equipped with RFID chips serve as the primary means of authentication, allowing each voter to be uniquely identified. Upon presentation of the RFID-enabled voter ID card, OTPs are generated and sent to the respective voters for validation. This multi-factor authentication process adds layers of security, reducing the risk of fraudulent voting practices.

Biometric verification, such as fingerprint or iris scans, further enhances the authentication process by validating the physical characteristics of the voter. This additional layer of security ensures that only authorized individuals can cast their votes, thereby upholding the integrity of the electoral process.The system facilitates electronic voting through touchscreen interfaces, providing voters with a user-friendly and intuitive voting experience. Encrypted data transmission to a central server ensures the security and confidentiality of the voting data, protecting it from unauthorized access or tampering.Real-time monitoring and auditing capabilities enhance transparency and trust in the electoral process by enabling election officials to monitor voting activity and verify the integrity of the voting data in real-time. This transparency helps to instill confidence among stakeholders and the public, reinforcing the credibility of the electoral process.Overall, the integration of RFID technology, OTP authentication, and biometric verification in the EVM project offers a robust and secure solution for conducting elections. By combining these advanced technologies, the system ensures the security, reliability, and transparency of the voting process, thereby upholding the principles of democracy.

VII. Modules Used

A. Micro controller

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 chip. It's part of the Arduino family, known for its versatility in electronics prototyping and DIY projects. The Mega 2560 stands out due to its extensive array of digital and analog I/O pins (54 digital I/O pins and 16 analog inputs), making it suitable for more complex projects requiring multiple sensors, actuators, and communication interfaces. It features a USB interface for programming and power, as well as compatibility with various expansion shields to extend its capabilities. Its larger memory and pin count compared to other Arduino boards make it ideal for projects requiring more processing power and connectivity option.

B. SIM 900 GSM

GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL Modem is SIM900A Dual-band GSM / GPRS device, works on frequencies 900 MHZ and 1800 MHZ. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 3V3 and 5V DC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051 etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600115200 bps through AT (Attention) commands. This GSM/ GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface. The modem can be interfaced with a Microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (serial communication

C. Keypad

Keypad is used for giving the data input of a passcode after entering into the vehicle for the validation purpose which is a 4*3 matrix keyboard connected to a microcontroller it shows a 4*3 matrix which were connected to two ports where two rows are connected to a output port and two columns are connected to a input port if no key was pressed reading through input port will be taken for all columns since they were connected to a high voltage V_{cc}. If all the rows were grounded and a key is pressed one column made 0 because pressed column made grounded .and there will be a function which runs continuously to detect or identify the key which was pressed.

D. LCD (Liquid Crystal Display):

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

E. RFID ID READER

RFID (Radio Frequency Identification) ID readers are devices used to wirelessly identify and track tags attached to objects or individuals. They consist of an antenna, a transceiver, and a decoder. When the reader sends out radio waves, the tag responds with its unique identification information. RFID ID readers are commonly used in various applications such as access control, inventory management, and asset tracking. They come in different form factors including handheld, fixed, and integrated into other devices like smartphones or security gates. The data captured by RFID ID readers can be integrated into databases or systems for further processing and analysis.

VIII. SOFTWARE USED

Arduino IDE: It is an open-source software, designed by Arduino. cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process .It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code.

Thing speak : Thing Speak is a platform providing various services exclusively targeted for building IoT applications. It offers the capabilities of real-time data collection, visualizing the collected data in the form of charts, ability to create plugins and apps for colaborating with web services, social network and other API.

IX CONCLUSION

The development and implementation of an RFID-based electronic voting machine integrated with OTP and biometric verification signify a significant advancement in enhancing the security and reliability of the voting process. Through rigorous testing and evaluation, we have successfully demonstrated the efficacy of this system in mitigating risks associated with unauthorized access and fraudulent activities during elections. By harnessing advanced technologies, we have effectively addressed critical concerns such as voter authentication and ballot integrity. The integration of RFID technology ensures accurate and tamper-resistant voter identification, while OTP and biometric verification mechanisms provide additional layers of security, thereby safeguarding the integrity of the electoral process.Our system not only enhances the security of elections but also promotes transparency and accountability. By

providing real-time monitoring and auditing capabilities, we enable election officials to track voting activity and verify the authenticity of ballots, thereby bolstering trust in democratic processes.

Overall, the development and deployment of our RFID-based electronic voting machine with OTP and biometric verification mark a significant milestone in advancing the security and reliability of elections. By leveraging cutting-edge technologies, we have made substantial strides towards ensuring the integrity of democratic processes and upholding the fundamental principles of fair and transparent elections.

X. FUTURE ENHANCEMENTS

The future enhancements of an RFID-based voting system integrating biometric verification and OTP authentication could focus on several areas to further improve security, accessibility, and efficiency:Blockchain Integration: Implementing blockchain technology can enhance the security and transparency of the voting process by creating an immutable and decentralized ledger of all voting transactions. This ensures that votes are securely recorded and cannot be altered or tampered with, thereby increasing trust in the electoral process.Enhanced Biometric Recognition: Research and development efforts can focus on improving biometric recognition algorithms to enhance accuracy and reliability. Advancements in biometric technologies such as facial recognition or vein pattern recognition can further strengthen voter authentication and reduce the risk of identity fraud.Multi-factor Authentication: Introducing additional authentication factors, such as voice recognition or behavioral biometrics, can add an extra layer of security to the voting process. By combining multiple biometric modalities with OTP authentication, the system can provide robust protection against unauthorized access.Mobile Voting Applications: Developing mobile voting applications that integrate with the RFID-based voting system can enhance accessibility and convenience for voters. Mobile applications can allow voters to securely cast their ballots from anywhere using their smartphones, thereby increasing voter turnout and participation.Enhanced Encryption and Data Security: Implementing advanced encryption techniques and data security measures can further protect sensitive voter information and voting data from cyber threats. Secure communication protocols and data encryption algorithms can prevent unauthorized access and ensure the confidentiality of voting transactions.Usability and User Experience Improvements: Continuously improving the usability and user experience of the voting system can enhance voter satisfaction and confidence. User-friendly interfaces, clear instructions, and accessibility features can ensure that voters of all abilities can easily navigate the voting process.Real-time Monitoring and Auditing: Enhancing real-time monitoring and auditing capabilities can enable election officials to detect and respond to irregularities or security breaches promptly. Automated alerts and notifications can alert officials to any suspicious activity, allowing for immediate action to be taken.

By focusing on these future enhancements, an RFID-based voting system integrated with biometric verification and OTP authentication can evolve into a highly secure, accessible, and efficient solution for conducting elections while maintaining the integrity and transparency of the democratic process.

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