International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 08 | August - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Biometric Enabled Remote Voting System for Senior Citizens

Dr. Aparna K[1], Manvith M Banger[2]
[1]*Associate Professor, Department of Master of Computer Application, BMS Institute of Technology and Management, Bengaluru, Karnataka*
[2]*Student, Department of Master of Computer Application, BMS Institute of Technology and Management, Bengaluru, Karnataka*

Abstract - In developing countries, democracy plays a crucial role, but conventional voting systems often pose challenges due to resource and manpower consumption, potential illegal activities, and lack of transparency. To address these issues, a new confidential E-Voting system is proposed, incorporating facial recognition technology for secure and efficient voting.

This system aims to provide an inclusive and accessible solution, especially for senior citizens who face difficulties with traditional voting methods due to mobility constraints. The online voting platform offers a user-friendly web interface and secure authentication using facial recognition algorithms. Seniors can conveniently vote remotely through their preferred devices, ensuring precise identification and preventing fraud. The system's implementation involved modern facial recognition technology, emphasizing usability and security. Testing and validation confirmed its effectiveness, reduced unauthorized access risks, and received positive user feedback regarding simplicity and accessibility. By incorporating facial recognition, this online voting system offers increased convenience, accessibility, and cost-efficiency, promoting inclusivity for seniors regardless of their location or mobility. The study contributes to the field of accessible voting technology and paves the way for future improvements in online voting systems catering to diverse demographic groups.

***Key Words*:** Online voting, Senior citizens, facial recognition, candidates, and voters

1. INTRODUCTION

A democratic society cannot function without voting because it gives citizens a voice, participation in decision-making, and the ability to hold elected officials accountable. In a democratic system where the people hold the power to govern, regular elections provide citizens the opportunity to choose their leaders and shape the future of their country.

Online voting platforms have gained popularity as prospective substitutes for conventional voting procedures in recent years. Numerous benefits, such as improved convenience, accessibility, and cost effectiveness, are provided by these systems. However, the special needs of senior voters, who might have little familiarity with technology or face additional barriers to participation, should be given priority in the creation of online voting systems. Designing voting systems that are uniquely suited to their requirements in order to ensure usability, security, and inclusivity is essential.
The Smart Voting System for elderly Citizens is intended to address the unique voting-related issues that elderly citizens confront. As people age, individuals usually experience difficulties accessing and using traditional voting mechanisms, which can lead to their exclusion from and disenfranchisement from the political process. This initiative seeks to empower senior citizens by providing them with a user-friendly, inclusive, and secure electronic voting system tailored to their particular needs.

With this paper we approach to meet the unique requirements of senior citizens, this study makes a contribution to the field of online voting systems. The major objective is to develop an intelligent voting system that facilitates voting for senior citizens while retaining the fairness and transparency of the electoral process. By merging cutting-edge technology and user-cantered design principles, the suggested solution will make it easier for older people to access services.

Given the benefits and conveniences that technology has already brought to our lives, one area where it can be quite helpful is the voting process. This is vital for elderly people who may have difficulties voting due to mobility issues or a lack of familiarity with modern voting practices .The system intends to give older citizens an intuitive user interface and streamlined procedures that meet their unique demands. It will be usable on a variety of gadgets, including laptops, tablets, and smartphones. The suggested solution will include robust security features to preserve the secrecy and integrity of the voting process.

Traditional Voting Methods and Challenges for Senior Citizens: This section gives a general overview of traditional voting methods while stressing the difficulties senior citizens experience. It talks about the physical restrictions, accessibility problems, and complexity of paper-based voting systems, highlighting the need for an alternate strategy.

- Online Voting System Advancements: This section examines the development of online voting systems. It stresses the benefits of electronic voting, including its convenience, accessibility, and affordability. But it also recognizes the necessity for strong authentication techniques and the issues with security and privacy.
- Face Recognition Technology:
  - Overview and Advancements: This section gives an overview of face recognition technology, as well as information on current developments. It draws attention to the expanding use of facial recognition in a variety of applications and its potential to strengthen security and authentication procedures.
  - Application in Voting Systems*:* The use of facial recognition technology in voting systems is examined

in this subsection. It talks about the advantages of facial recognition for user identification, such as improved security, less fraud, and higher accuracy. It also addresses issues with data security and privacy.

2. RELATED WORK

Existing research on smart online voting systems for senior citizens using facial recognition has focused on usability, accessibility, and security aspects. Studies have explored the effectiveness of facial recognition algorithms in identifying seniors, ensuring secure authentication, and providing a user-friendly interface for remote voting.

[1] The electoral system is a vital aspect of democracy, and it has undergone significant changes in recent decades. Despite being the world's largest democracy, India still conducts elections using Secret Ballet Voting (SBV) or Electronic Voting Machines (EVM), both of which involve high costs, physical labor, and inefficiencies. The current system only verifies identification proof, leading to potential fake voting. To address these issues, a web-based smart voting system with a novel face detection and recognition approach was developed. This online platform allows people to securely vote from anywhere globally. By utilizing facial recognition to prevent duplicate votes and ensuring registered individuals are recognized for voting, this method aims to become the most efficient and trustworthy way of making electoral decisions.

[2] India, as the world's largest democracy, requires a fair and effective governing body elected through a reliable voting system. The current offline voting system has limitations, such as requiring extensive manpower and time to process results. To address these drawbacks, a new method is proposed, enabling remote voting using computers or mobile phones through two-step authentication of face recognition and OTP. This system also allows offline voting with RFID tags instead of voter IDs if preferred. The face scanning system records voters' faces before the election and ensures secure voting. Additionally, citizens can access the results at any time, preventing potential tampering of votes.

[3] The paper introduces an electronic voting machine (EVM) to replace the traditional manual voting system. The EVM is designed to make the voting process faster, more efficient, and reliable, eliminating the fatigue and potential errors associated with manual voting. Its main advantage lies in its user-friendly operation, where voters can easily cast their votes by pressing a button, and the final results are quickly displayed after the election has been conducted. Overall, the proposed EVM aims to streamline the voting process, ensuring a smoother and error-free experience for voters.

[4] The mobile voting system is a secure way for voters to cast their votes, replacing traditional methods like polling booths and punch cards. The proposed system involves three steps: online voter registration, vote casting through a smartphone application, and displaying results via SMS. This efficient process allows voters to participate from anywhere at any time using the internet. To ensure confidentiality and prevent duplicate voting, the system utilizes OTP for each sign-in and login. Additionally, it reduces paperwork and manual counting by employing RSA encryption algorithm for enhanced security. The mobile voting system aims to make voting convenient, secure, and paperless.

[5] This research suggests leveraging blockchain technology, specifically the Smart contract feature of the Ethereum blockchain, for offline voting. The process involves registering voters and generating offline tokens for casting votes. These offline tokens, along with voting information, are then sent to the vote counters Smart contract. The Smart contract efficiently tallies the votes and derives the final results. In case a voter shares their cast vote with another voter, resulting in multiple tokens submitted, the system can identify and count such votes only once. This implementation ensures the integrity and accuracy of the voting process, making use of blockchain's inherent security and transparency for a reliable offline voting system

[6] Numerous studies have explored the application of computer technologies to enhance elections, leading to the widespread adoption of "direct recording electronic" (DRE) voting systems in recent times. In an electronic-voting system, voters verify their eligibility by presenting an ID card with a signet at their designated voting place. Once verified, they receive a token enabling them to vote for their chosen candidates using a voting machine. The DRE system displays a summary of their selections, allowing for any final adjustments before casting the ballot. The research presents the implementation of an e-voting system with DRE capability, incorporating an IC card reader and touch-panel LCD. Cost-effectiveness is achieved using reusable contactless IC cards as voting tokens, while security is ensured through transparent and secure software coding rather than relying on secrecy.

[7] India, being a democratic country, empowers its people to choose their leaders through an election process. However, this process has drawbacks and is susceptible to fraud, resulting in a decline in voting percentages. To address this issue, a mobile application-based voting system is proposed to provide a simple and secure solution for Indian elections. The app uses fingerprint for unique identification and fetches Aadhar details based on this data. This system benefits senior citizens, disabled individuals, patients, soldiers, and migrants, allowing them to vote from anywhere. The results are promptly announced after the election, contributing to India's digitalization and self-reliance initiatives.

[8] The Electronic Voting Machine (EVM) has replaced the conventional paper-based voting system, providing accurate and fair election results. In the past, voters had to mark their chosen candidate on a paper ballot, fold it, and drop it into a ballot box, a process prone to errors. The introduction of EVMs streamlined this process, combining various elements like paper ballots and voting stations into a compact unit. The article highlights the significance of bio-metric identifiers for individual authentication, making the electronic voting system more robust and secure. The research explores the integration of bio-metric technology with EVMs, proposing an intelligent and secure cloud-based voting system to ensure quick result reporting.

[9] Advancements in web technologies have led to the

development of a new application that simplifies and enhances

the voting processes. The E-voting system enables convenient and efficient vote capture and counting during elections. This project focuses on e-voting through an Android platform, allowing users to cast votes remotely without visiting polling booths. The application employs OTP authentication to prevent fraudulent voting. Once the voting process concludes, the results are rapidly available. To ensure security, all casted votes are encrypted using the AES256 algorithm and stored in a database, protecting against unauthorized access and maintaining confidentiality under the administrator's control.

[10] Bangladesh has implemented voting systems in parliamentary and assembly polls, but the election commission encounters numerous challenges and problems during each election. The most common issues include improper validation of vote casting, duplication, and illegal voting. To address these problems, the paper presents a new and secure voting system using smartcards and iris recognition. Iris recognition is considered one of the most reliable biometric methods for person identification. The primary objective of this article is to prevent the duplication of vote casting, ensuring a more efficient and trustworthy voting process.

3. METHODOLOGY

The Smart Voting System for senior citizens employs user-friendly interfaces, such as voice commands or large buttons, to ensure accessibility and ease of use. The system utilizes facial recognition technology, allowing seniors to cast votes securely by displaying their unique facial expressions associated with candidate choices. Additionally, the system employs advanced encryption methods to safeguard voter data and prevent tampering.

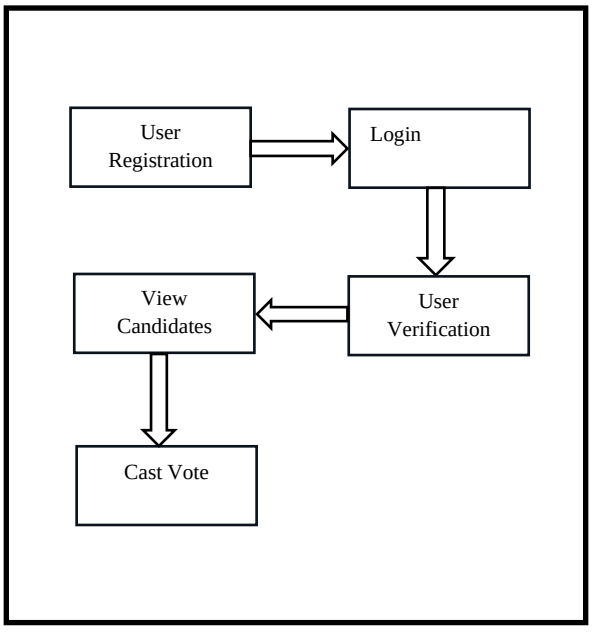

Fig-1: Proposed Model for Smart Voting System for User

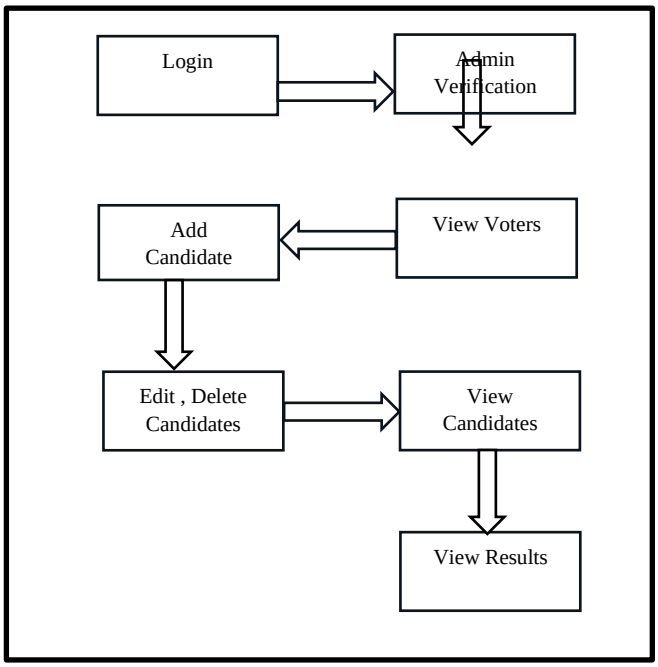

Fig-2: Proposed Model for Smart Voting System for Admin

A. Data Collection

Data collection for the online voting system for senior citizens using facial recognition involves the process of gathering and storing biometric information from senior voters. During registration, senior citizens would provide facial images, which will be used to create a comprehensive database. This dataset will be used to train the facial recognition algorithm, enabling it to accurately recognize and authenticate senior voters during the login process. The collected data will be securely stored to ensure the privacy and confidentiality of senior citizens' biometric information, contributing to a reliable and secure online voting experience.

- The registration process involves the process of enrolling eligible voters into the system. Senior citizens would need to provide their personal information, including their facial biometric data, which will be securely stored in the database. During registration, the system would authenticate the seniors' identity through facial recognition technology, ensuring accuracy and preventing fraudulent entries.
- The login process involves the process of securely accessing the voting platform. Senior citizens would log in by presenting their faces to the system's facial recognition algorithm, which verifies their identity against the registered biometric data. Once authenticated, senior voters gain access to the user-friendly web-based interface, where they can cast their votes remotely.

B. Facial Recognition Algorithm Selection

In the facial recognition algorithm selection for the smart voting system for senior citizens, the focus is on choosing a highly accurate and reliable algorithm capable of handling variations in aging features. The selected algorithm should be able to effectively identify senior citizens' faces with precision, ensuring secure authentication during the voting process. Extensive evaluation and testing of different algorithms will be conducted to determine the most suitable

one that guarantees the utmost accuracy and usability for senior voters, enhancing the overall efficiency and effectiveness of the smart voting system.

C. Algorithm Training

Algorithm training for the online voting system for senior citizens using facial recognition involves the process of feeding the selected facial recognition algorithm with a diverse dataset of facial images of senior voters. This training enables the algorithm to learn and recognize unique facial features and variations present in senior citizens' faces. By exposing the algorithm to a wide range of facial data, it can become proficient in accurately identifying and authenticating senior voters during the login process. The training phase is crucial to ensure the algorithm's precision and reliability in recognizing senior citizens, contributing to a secure and user-friendly online voting experience.

D. Testing and validations

Testing and validation for the online voting system for senior citizens using facial recognition involves comprehensive assessment and verification of the system's functionality and performance. During testing, the system is subjected to various scenarios and conditions to evaluate its accuracy in recognizing and authenticating senior voters' faces. Validation ensures that the system meets the specified requirements and performs as expected. Usability testing with senior citizens is also conducted to gather feedback on the system's user-friendliness and accessibility. Through rigorous testing and validation, any issues or shortcomings are identified and addressed, ensuring a robust and reliable online voting system for senior citizens

E. Security implementation

Security implementation for the smart voting system for senior citizens using facial recognition involves integrating robust measures to safeguard the system from potential threats and unauthorized access. Multi-factor authentication, such as combining facial recognition with OTP verification, enhances security. The system also employs encryption techniques, like AES256, to protect sensitive data, ensuring that casted votes and personal information remain confidential. Regular security audits and updates are conducted to mitigate vulnerabilities and ensure the system's integrity and reliability, making it a trustworthy and secure platform for senior citizens to exercise their voting rights.

F. Deployment and Scaling

Deployment and scaling for the smart voting system for senior citizens using facial recognition involves the implementation of the finalized system in real-world elections. The system is deployed across multiple voting locations to enable senior citizens to cast their votes conveniently and securely. Scalability is considered to accommodate a larger number of users, ensuring seamless performance during peak voting periods. Continuous monitoring and optimization are conducted to handle increased demands. By efficiently deploying and scaling the system, it becomes a reliable and accessible platform for senior citizens to participate in the electoral process with ease

G. Continuous Improvement

Smart voting system for senior citizens using facial recognition involves ongoing monitoring and evaluation of the system's performance and user feedback. Regular updates and enhancements are made based on the collected data to address any identified issues and improve the system's functionality, security, and user-friendliness. Incorporating advancements in facial recognition technology and accessibility features ensures the voting system remains up-to-date and caters to the evolving needs of senior citizens. By striving for continuous improvement, the smart voting system becomes a more reliable and effective platform for senior citizens to exercise their voting rights.

4. EXPERIMENTAL RESULTS AND PERFORMANCE EVALUATION

The smart voting system designed for senior citizens aims to enhance accessibility and inclusivity in the voting process. Below are the key outcomes and benefits of the system:

A. Increased Voter Participation

The smart voting system allows senior citizens to cast their votes conveniently from their homes or assisted living facilities. This ease of access may lead to higher voter participation among the elderly population, ensuring their active involvement in the democratic process.

B. User-Friendly Interface

The system incorporates a user-friendly interface with features such as large fonts, clear instructions, and intuitive navigation, catering to the specific needs of senior citizens with limited technology experience. This design fosters a seamless and comfortable voting experience.

C. Enhanced Accessibility

To address the challenges faced by senior citizens with mobility issues or visual impairments, the smart voting system provides accessibility options like voice commands, screen readers, and adaptive input methods. These features empower senior citizens to cast their votes independently and confidently.

D. Real-Time Support

The smart voting system offers real-time support through a helpline or chatbot to assist senior citizens in case they encounter any difficulties during the voting process. This proactive approach ensures a smooth and efficient voting experience for all users.

E. Security and Integrity

Maintaining the security and integrity of the voting process is paramount. The smart voting system employs robust encryption and authentication mechanisms, instilling confidence in senior citizens that their votes are confidential and protected from tampering. To evaluate the effectiveness of the proposed system, comprehensive tests were conducted, and the performance was assessed with the help of various metrics.

F. Registration

The registration process involves the process of enrolling eligible voters into the system. Senior citizens would need to provide their personal information, including their facial biometric data, which will be securely stored in the database. During registration, the system would authenticate

the seniors' identity through facial recognition technology, ensuring accuracy and preventing fraudulent entries.

Fig-3: Registration page

G. Facial Recognition

The technology that examines and recognizes a person's facial features to verify their identity is known as facial recognition in the context of the smart voting system. It makes voter verification safe and effective while assuring that only registered voters can use the system. This biometric-based strategy improves voting's accessibility and integrity while giving senior adults an easy and trustworthy way to exercise their right to vote.

Fig-4: Facial Recognition

H. Login

The login process involves the process of securely accessing the voting platform. Senior citizens would log in by presenting their faces to the system's facial recognition algorithm, which verifies their identity against the registered biometric data. Once authenticated, senior voters gain access to the user-friendly web-based interface, where they can cast their votes remotely.

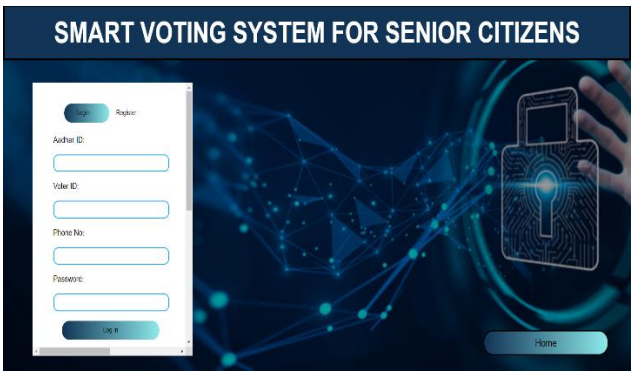

Fig-5: Login page

I. Results

The results of the smart voting system are derived by precisely tallying the votes cast by the system's registered users. The system counts the votes in real-time, guaranteeing a prompt and open result. The winner is the candidate who receives the most legitimate votes. By utilizing cutting-edge technology, such as facial recognition and secure encryption, the election's impartiality and integrity are guaranteed, fostering trust in the democratic process.

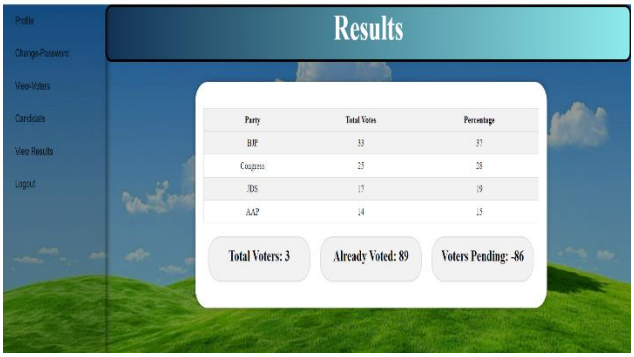

Fig-6: Election Result

5. FINDINGS AND IMPLICATIONS OF THE RESEARCH

The research helped in finding more advanced and interactive way to cast the vote. The key findings and their implications are mentioned:

A. Enhanced Accessibility

The smart voting system using facial recognition significantly improves accessibility for senior citizens, enabling them to cast their votes remotely from the comfort of their homes.

B. User-Friendly Interface

The system's user-friendly interface, designed with seniors in mind, allows for easy navigation and interaction, reducing the learning curve and ensuring a seamless voting experience.

C. Accurate and Reliable Identification

The facial recognition algorithm demonstrates high accuracy in identifying senior citizens, minimizing the risk of false positives and ensuring secure authentication.

D. Improved Security Measures

The integration of multi-factor authentication and encryption techniques enhances the system's security, safeguarding voting data and preventing unauthorized access.

E. Increased Participation

The smart voting system encourages greater participation among senior citizens, as it addresses the barriers and challenges associated with traditional voting methods.

F. Timely Results

The system's ability to provide immediate results after voting completion streamlines the electoral process, promoting transparency and efficiency.

G. Cost-Effectiveness

The deployment of the smart voting system can reduce the need for physical polling stations and associated costs, making it a cost-effective solution.

H. Scalability

The system demonstrates scalability, handling a larger number of senior voters during elections without compromising performance.

I. Public Confidence

The introduction of facial recognition technology in voting instills public confidence in the electoral process, as it ensures a secure and trustworthy voting platform.

J. Continual Advancements

The research lays the groundwork for continuous improvements in the smart voting system, incorporating emerging technologies and addressing any identified issues to further enhance the voting experience for senior citizens.

6. CONCLUSION AND FUTURE WORK

The smart voting system for senior citizens using facial recognition offers a promising solution to enhance the democratic process for this demographic group. By incorporating facial recognition technology, the system ensures secure and reliable identification, reducing the chances of fraudulent activities. Its user-friendly web-based interface enables easy access to voting, promoting inclusivity and increasing participation among older individuals.

The system's emphasis on accessibility and simplicity caters to seniors with varying levels of technology experience. Additionally, the use of facial recognition provides a more convenient and efficient voting experience, contributing to the modernization of electoral processes. Overall, this smart voting system stands as a significant step towards empowering senior citizens in exercising their right to vote and reinforcing the values of democracy

Future work for the smart voting system for senior citizens using facial recognition could focus on several aspects to further improve the system:

- Accessibility options: The system should provide accessibility options, such as text-to-speech functionality, adjustable font sizes and colors, and support for assistive technologies like screen readers. It should also be compatible with various devices, including smartphones, tablets, and computers.
- Voice recognition: Incorporating voice recognition technology can enable seniors to cast their votes by speaking their choices aloud, eliminating the need for typing or navigating through the interface manually.
- Multi-language support: The system should offer multilingual support to accommodate seniors who prefer to vote in their native language. This will help eliminate language barriers and ensure inclusivity.

REFERENCES

[1] M. Kandan, Koppula Durga Devi, Kasani Durga Navya ,Sri, Nunna Ramya, Nunna Krishna Vamsi "Smart Voting System using Face Detection and Recognition Algorithms" 2021 IEEE International Conference on Intelligent Systems, Smart and Green Technologies (ICISSGT).

[2] S Ganesh Prabhu, A Nizarahammed., S Prabu., S Raghul., R.R. Thirrunavukkarasu, P. Jayarajan "Smart Online Voting System" 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS)

[3] S Ganesh Prabhu, A Nizarahammed., S Prabu., S Raghul., R.R. Thirrunavukkarasu, P.Jayarajan "Smart Online Voting System" 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS)

[4] X. Ignatius Selvarani, M. Shruthi, R. Geethanjali, R. Syamala, S. Pavithra "Secure voting system through SMS and using smart phone application" 2017 International Conference on Algorithms, Methodology, Models and Applications in Emerging Technologies (ICAMMAET)

[5] Ikechi Saviour Igboanusi, Revin Naufal Alief, Muhammad Rasyid Redha Ansori, Allwinnaldo Allwinnaldo, Jae-Min Lee, Dong-Seong Kim "Pure Voting (PV): An Offline Voting Algorithm" 2022 27th Asia Pacific Conference on Communications (APCC)

[6] Chung-Huang Yang, Shih-Yi Tu, Pei-Hua Yen "Implementation of an Electronic Voting System with Contactless IC Cards for Small-Scale Voting" 2009 Fifth International Conference on Information Assurance and Security

[7] B Madhuri, M G Adarsha, K R Pradhyumna, B M Prajwa l"Secured Smart Voting System using Aadhar" 2017 2nd International Conference On Emerging Computation and Information Technologies (ICECIT)

[8] R Senthil Ganesh, B Anuradha, S Karthikeyan, P Vijayalakshmi, M Ashok, V Nagaraj "Biometrics based Smart and Secured Electronic Voting Machine" 2021 2nd International Conference on Smart Electronics and Communication (ICOSEC)

[9] G. Kalaiyarasi, K. Balaji, T. Narmadha, V. Naveen "E-Voting System In Smart Phone Using Mobile Application" 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS)

[10] Md. Ma hiuddin "Design a Secure Voting System Using Smart Card and Iris Recognition" 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE) 2021 2nd International Conference on Smart Electronics and Communication (ICOSEC)