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Efficient Bharat Voting System for the blind Peoples

An intuitive and accessible voting platform developed to allow blind and visually impaired individuals to vote autonomously and securely through voice commands.

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Abstract: Voting is a foundational element of democracy, enabling individuals to participate in the governance process. People with visual impairments are frequently excluded from the voting process because conventional systems are not designed to meet their needs. In India, the current electoral infrastructure creates several barriers for blind voters—such as reliance on others, absence of privacy, and lack of supportive technologies. This project introduces the 'Efficient Bharat Voting System or Blind People', a technological approach designed to ensure confidential, inclusive, and independent voting. The solution employs cutting-edge technologies like AI, ML, and speech recognition to enable seamless interaction. Through tactile feedback, voice navigation, and biometric verification, It delivers a reliable and accessible platform that empowers all voters, including those with vision impairments, to cast their vote independently. The initiative strives to modernize voting for blind individuals and promote true democratic engagement in Bharat.

***IndexTerms* - Mel Frequency Cepstral Coefficient (MFCC), Support Vector Machine (SVM), Speech Emotion Recognition (SER), Voice Activity Detector (VAD), Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS), Convolutional Neural Network (CNN), Deep neural networks (DNN),Perceptron Neural Networks (PNN), Multilayer Perceptron Neural Networks (MLP), Long Short-Term Memory (LSTM)**

I. INTRODUCTION

Democracy is built on the principle of equal opportunity for participation. However, Voting continues to pose serious difficulties for numerous individuals with visual impairments. In a country like India—characterized by immense diversity and high population density—ensuring inclusive access to civic rights such as voting is both crucial and complex. Blind voters often have to depend on others at polling stations, compromising the confidentiality and autonomy of their vote. Furthermore, the current design of Electronic Voting Machines (EVMs) lacks features tailored to their needs, making independent voting difficult.

In response to these concerns, this research introduces an innovative and accessible solution tailored for visually impaired voters: the **Efficient Bharat Voting System for Blind People**. This system enables users to interact with the voting interface using spoken commands, supported by voice output that delivers step-by-step instructions, candidate information, and confirmation alerts—allowing users to participate without relying on visual inputs.

Security is a core aspect of the system, which incorporates biometric authentication, Including fingerprint authentication, the system verifies voter identity to restrict access solely to legitimate participants. To accommodate different levels of familiarity with assistive tools, the system also features tactile interfaces, like Braille-enabled buttons or touch-sensitive surfaces. Designed to be compact and easy to deploy, it is suitable for use in both urban and rural election setups.

In addition to its technical features, The system underwent extensive evaluation in controlled simulations resembling real voting conditions. Input gathered from users was applied to refine its design. Support for multiple regional languages and customizable audio prompts also ensures accessibility across India's varied linguistic landscape.

Ultimately, this system seeks to serve as a model for inclusive voting solutions, not just in India but globally. By combining empathy with technological innovation, it offers a dignified and independent voting experience for visually impaired citizens—affirming their equal role in the democratic process.

II. LITERATURE REVIEW

The evolution of electronic voting systems (e-voting) has increasingly focused on enhancing accessibility and security, Particularly when considering those who are visually impaired. Researchers have explored numerous approaches to make voting more inclusive, incorporating technologies such as blockchain, biometric verification, and cloud computing.

Wu, Guande, Lin Jianzhe, and Claudio T. Silva developed a system called IntentVizor was introduced, using interactive video summaries to support blind users in navigating content, demonstrating the role of inclusive design in enhancing civic access. [1].

In another study, Abhishek Parmar and his team introduced a decentralized e-voting framework powered by blockchain. Their system ensures vote security using tamper-proof data storage and enhances voter authentication through face recognition and One-Time Password (OTP) mechanisms[2].

To overcome the limitations associated with traditional voting methods in India, Ramya Govindaraj and colleagues designed an a digital voting platform featuring a three-tier authentication process. This strategy both strengthens voting security and makes voter verification more accessible, thereby promoting wider involvement. [3].

Puja Sharma's research presented A secure voting mechanism utilizing Aadhaar-linked biometric checks, especially helpful for migrant populations lacking voter ID access.[4].

Concerns regarding election fraud and EVM manipulation were tackled by Rohit Sroa and his team. They proposed a voting model based on **hash graph** technology, which enhances security while preserving voter anonymity[5].

Sreenivasa et al. designed a secure online voting system using a **three-step verification** process. Their framework enhances the protection of voter data and supports reliable authentication mechanisms [6]

Furthermore, Ngangbam Indrason advocated for the use of blockchain in creating boothless e-voting systems. According to his research, decentralization ensures vote authenticity and reduces the risk of tampering, making blockchain a promising backbone for future elections[7].

Krishan Mohan Yadav emphasized the benefits of transitioning to digital voting systems, including improved efficiency, reduced chances of malpractice, and time savings. His work highlighted the increasing application of online voting in areas beyond politics, such as education, sports, and corporate governance[8].

Collectively, these studies underscore the potential of modern technologies to create more secure, accessible, and efficient voting environments—especially for individuals with disabilities. This project extends these previous developments to further tailor solutions for blind users in India.

III. METHODOLOGY

The design process for the Efficient Bharat Voting solution tailored for visually impaired users was structured carefully. Structured to ensure accessibility, usability, and security. The project was executed through a sequence of phases, including requirement analysis, System architecture planning, hardware selection, coding, and related activities development, and system testing.

3.1 Requirement Analysis

The initial phase involved identifying key obstacles faced by blind voters when using conventional electronic voting systems. Based on this assessment, the following core requirements were established:

- A voice-controlled input mechanism for user interaction
- Clear and consistent auditory instructions
- A user-friendly and simple hardware interface
- Methods to prevent repeat voting
- A secure system to store votes reliably

3.2 System Design

The system was designed using a modular architecture. A block diagram was created to represent the interaction among components, which included:

- **Arduino Uno** as the central controller
- **Voice recognition module** to capture and interpret commands
- **Speaker module** to provide audio feedback
- **Keypad** for manual input as a fallback option
- **Memory unit** to securely store voting data

Additionally, flowcharts were prepared to represent logical sequences such as voter authentication, vote selection, confirmation, and data recording.

3.3 Component Selection and Setup

The choice of hardware was guided by the operational needs of the system were the guiding factor for its hardware and software decisions.

- **Arduino Uno** for its affordability and efficiency
- **Voice Recognition Module V3** capable of handling up to 20 pre-trained commands
- **Speaker** for real-time feedback and voice prompts
- **12V Battery** to ensure portability and uninterrupted power
- **Keypad** as an alternative input method

Preliminary trials were conducted on a breadboard setup before finalizing the prototype.

3.4 Programming and Logic Implementation

The programming was carried out using the Arduino IDE to implement the system's core logic.

- Recognize and process specific voice commands
- Match inputs with candidate names
- Provide step-by-step audio instructions
- Record votes in memory
- Block duplicate voting attempts

Appropriate libraries were incorporated to handle voice recognition and audio output functionality.

3.5 Integration and Testing

Once individual components were tested, the system was assembled and evaluated as a complete unit. Various test cases were executed to check responses to valid and invalid inputs.

Key testing phases included:

- **Functional Testing** to confirm each feature worked as intended
- **User Testing** using blindfolded participants to simulate real-world scenarios
- **Edge Case Testing** involving background noise and silent input conditions to test system resilience

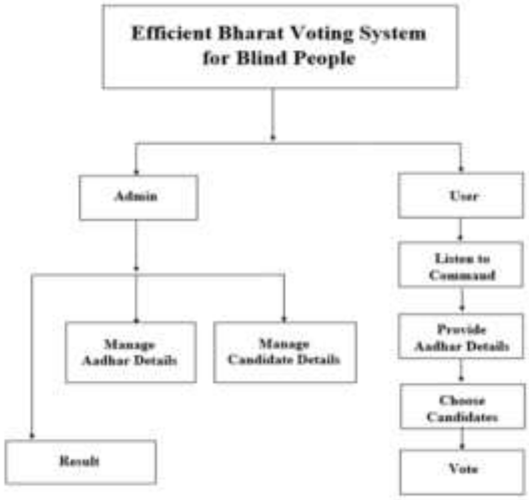

Fig. 3.1.1 System Workflow Diagram of the Accessible Voting System

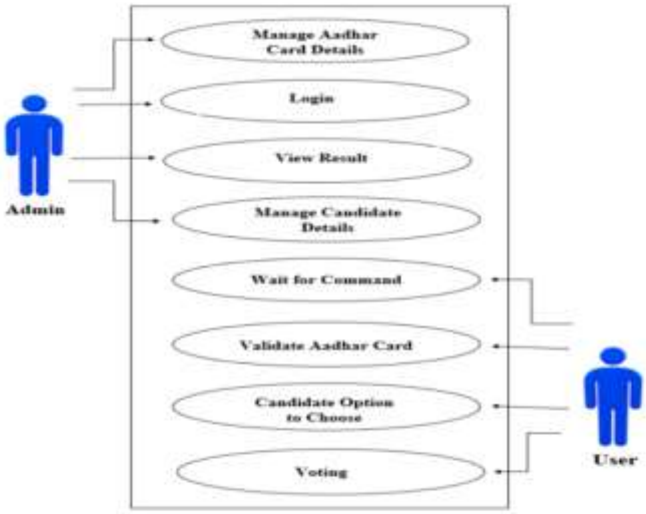

Fig. 3.1.2 interaction flow between admin and user in Bharat voting system

IV. IMPLEMENTATION AND EXPERIMENTAL SETUP

4.1 *System* Overview

The **Efficient Bharat Voting System for Blind People** is designed to enable visually impaired individuals to vote securely and independently. The system integrates speech recognition, tactile interfaces, and biometric verification to ensure both accessibility and voter authentication.

4.2 Implementation

Hardware Components:

- **Processing Unit:** A central microcontroller such as Arduino or Raspberry Pi manages the system's operations and communication.
- **Microphone:** Captures the voter's voice commands for processing.
- **Tactile Input Device:** Features such as a Braille keypad or raised-button interface allow users to interact through touch.
- **Biometric Scanner:** A fingerprint sensor is used to confirm voter identity before granting access.
- **Speaker or Headphones:** Provide audio instructions and confirmations to guide users through the process.

Software Components:

- **Login Control Module:** Restricts system access to authorized personnel (e.g., administrators).
- **Speech Recognition Module:** Converts voice commands into actionable text to help users select parties or candidates.
- **Voting Logic:** Manages the vote selection, confirmation, and secure storage of the data.
- **Database System:** Maintains records of users, election data, and vote entries with secure access control.
- **Text-to-Speech (TTS):** Provides audio responses, reading out candidate names and vote confirmations to the user.

4.3 Experimental Setup

To assess the system's real-world effectiveness, testing was conducted in a simulated environment that closely resembled an actual polling booth.

Participants: The test group comprised individuals who were blind or visually impaired, each with a different level of experience using assistive technologies.
Test Conditions: The voting tests were carried out in a quiet, controlled space to minimize external disruptions. Each participant voted in a private booth to ensure confidentiality.
Procedure:
Participants were first briefed on how to interact with the system using voice commands. They then completed a trial voting session to test the system independently.

Data Collected:

- **Voting Duration:** Time taken by each participant to complete the voting process.
- **Voice Command Accuracy:** How well the system interpreted user commands.
- **Response Time:** How quickly the system processed inputs and provided feedback.
- **User Feedback:** Participants shared their thoughts on the ease of use, interface design, and overall satisfaction.

4.4 Performance Evaluation

Key metrics used to evaluate the system included:

- **Ease of Use:** Most participants found the interface straightforward, with voice and tactile features enhancing usability
- **Recognition Accuracy:** The system effectively interpreted most voice inputs, though occasional errors were observed with strong accents or unclear speech.
- **Time Efficiency:** Voting sessions typically took under 10 minutes, making the process quick and manageable.
- **User Satisfaction:** The feedback played a key role in confirming the system's usability.

4.5 Challenges and Limitations

Although the system was successful, several challenges were recognized.

- **Speech Variability:** Difficulty in recognizing heavy accents or speech impairments.
- **Device Constraints:** Older hardware led to slower system responses.
- **Hardware Integration:** Ensuring smooth coordination between multiple devices required detailed calibration.

V. RESULTS AND DISCUSSION

The functionality of the system was assessed through a variety of black-box test scenarios, focusing on core features such as user registration, login validation, and secure data handling. Below are reworded explanations for each subsection:

5.1 *Username Validation*

This test series evaluated how the system responds to incorrect or missing usernames. The system successfully prompted users with appropriate messages when:

- A username started with a number
- The input was left blank

These outcomes confirm that the platform effectively prevents invalid entries during the initial login stage.

Test Case	Input	Tests Descriptions	Output
1	Usernames starts with number	A username cannot begin with a number.	Must enter characters.
2	Usernames is left blank	A username must not be empty.	Must enter username.

5.2 *Password Verification*

Tests were conducted to verify whether the system properly enforces password rules. When a password field was empty or mismatched, the system generated clear error alerts, encouraging secure login practices.

Test Case	Input	Test Description	Output
1	Password is left blank	The password field must be filled.	Must enter password
2	The entered password is invalid.	Valid passwords must be entered	Password mismatch

5.3 *Email Address Format Check*

Various incorrect email formats (e.g., containing spaces or missing '@' symbols) were submitted to assess system robustness. The system consistently rejected invalid formats and prompted the user to enter a valid email address, ensuring data consistency

Test Case	Input	Test Description	Output
1	Email address is not in correct format	Emails address should not have correct format	Invalid expression
2	Email address with space	Email addresses cannot contain spaces.	invalid expression
3	Email is left blank	The email field cannot be left empty	must enter email id

5.4 *Data Insertion Testing*

To evaluate the platform's database interaction:

- Mandatory fields were deliberately left blank
- Duplicate data entries were attempted
- Valid data was entered

The system accepted correct entries, rejected duplicates, and flagged incomplete submissions—indicating strong form validation and data control.

Test Case	Input	Tests Descriptions	Output
1	Mandatory field left empty	Mandatory field cannot be left empty	Must enter data
2	Duplicate entry	Duplicate entry not allowed	Approve error message
3	Input without about faults	Valid input	Record inserted successfully

5.5 *Record Deletion*

This set of tests confirmed that records cannot be deleted unless selected by the user, preventing accidental loss of data. Valid deletions proceeded only when the appropriate conditions were met.

Test Case	Input	Tests Descriptions	Output
1	Deletion attempted when no entries are selected	Entries, if there not selected, cannot be deleted.	Select any field
2	Deletion is valid when no errors are present.	Valid deletion	Record delete successfully

5.6 *Phone Number Validation*

Similar to earlier tests, the phone number field was examined for duplicate entries and formatting accuracy. Only properly formatted, unique numbers were accepted, reinforcing the system's validation layers

Test Case	Input	Tests Descriptions	Output
1	Mandatory field left empty	Mandatory field cannot be left empty	Must enter data
2	Duplicate entry	Duplicate entry not allowed	Approve error message
3	Input without about faults	Valid input	Record inserted successfully

These tests collectively validate the system's ability to guide users with clear error messages, enforce correct data formats, and protect the integrity of stored information. Overall, the voting system demonstrated high reliability in handling typical user interactions and preventing faulty data inputs.

VI. CHALLENGES AND LIMITATIONS

While the **Efficient Bharat Voting System for Blind People** demonstrates strong potential to improve electoral participation among visually impaired citizens, it also presents certain challenges that must be addressed for practical deployment and long-term sustainability.

1. Voice Recognition Limitations

The system's reliance on voice input makes it susceptible to misinterpretation due to regional accents, speech impairments, or background noise. Considering India's linguistic diversity, achieving consistent accuracy across all dialects remains a major challenge.

2. Emotion Detection Accuracy

Although the system integrates emotion recognition to enhance user experience, this technology is still evolving. Misreading emotional cues can lead to inappropriate responses or confusion, potentially impacting user confidence.

3. Hardware and Connectivity Constraints

Reliable hardware and stable internet connectivity are essential for optimal system performance. In remote or under-resourced areas, limited access to suitable devices or uninterrupted power supply can hinder deployment.

4. Data Security and Privacy Risks

Despite employing biometric verification and encryption, safeguarding voting data against cyber threats remains an ongoing concern. Maintaining confidentiality and preventing unauthorized access must be prioritized through advanced security protocols.

5. User Training and Familiarity

Successful adoption depends on users being comfortable with the technology. However, digital illiteracy, lack of exposure to assistive systems, and hesitation to adopt new tools may limit its reach. Comprehensive training and awareness campaigns are necessary.

6. Legal and Administrative Hurdles

Implementation on a national scale requires approval from electoral authorities and alignment with legal frameworks. The process of institutional integration and compliance with Election Commission guidelines may involve bureaucratic delays.

7. System Scalability and Maintenance

To ensure longevity, the system must be scalable and regularly updated. Ongoing support, software updates, and retraining of AI models are essential to adapt to evolving technologies and user needs.

8. Limited Inclusivity for Other Disabilities

Currently designed for the blind, the system does not yet cater to individuals with hearing, cognitive, or motor impairments. Expanding its capabilities to address a broader range of disabilities would be essential for holistic inclusivity.

VII. FUTURE WORK

Although the existing version of the Efficient Bharat Voting System for Blind People shows encouraging results, there are multiple opportunities for improvement that could enhance its functionality, flexibility, and practical effectiveness.

1. **Long-Term Performance Evaluation**

Future studies should monitor the system's performance over multiple election cycles. This would help determine whether it remains reliable, efficient, and user-friendly as technology and user behavior evolve.

2. **Diverse User Testing**

To create a more inclusive and responsive system, testing must include visually impaired individuals from different regions, age groups, educational levels, and language backgrounds. This would provide insights into specific needs across diverse populations and help fine-tune the interface.

3. **Expert Collaboration**

Partnering with specialists in accessibility, user experience design, and assistive technologies can lead to more refined system features. Expert guidance would help improve aspects such as audio navigation, command structure, and interface ergonomics.

4. **Personalized AI Assistance**

Integrating AI features to tailor the system to each user's unique interaction style could greatly improve user experience. For instance, the system could analyze a voter's past sessions to modify the pace of instructions or offer customized support based on their previous usage.

5. **Integration with Government Infrastructure**

Collaborating with electoral authorities, policy makers, and accessibility advocacy groups is essential for scaling up. Their involvement will ensure regulatory compliance and raise awareness about the system among the target user base.

6. **Support for Multilingual Voice Commands**

India's linguistic diversity calls for support in multiple regional languages. Future upgrades should include localized voice inputs and audio prompts to make the system accessible to all eligible voters, regardless of language.

VIII. CONCLUSION

This study aimed at assessing the Efficient Bharat Voting System for Blind People, created to tackle the specific difficulties encountered by visually impaired voters. The main goal was to develop a platform that guarantees accessibility, autonomy, and an intuitive experience for blind individuals during the voting process.

Through extensive testing and user feedback, the system demonstrated its capability to significantly improve voting accessibility. By incorporating tactile interfaces, clear audio instructions, and voice command-based interaction, the platform allowed visually impaired users to cast their votes without assistance—preserving both their autonomy and privacy.

Although the scope of testing was limited, the outcomes highlighted the importance of inclusive technology in strengthening democratic participation. The results reinforce the idea that accessible design is a necessity—not a luxury—especially when it comes to ensuring that all citizens can exercise their fundamental right to vote.

This project represents a meaningful step toward making elections more inclusive. Continued innovation, collaboration with experts, and integration with public infrastructure will be key to realizing a fully accessible electoral system in the future—not just in India, but globally.

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REFERENCES

[1] D. Choki, T. Wangchuk, and K. Dorji, "Design of Electronic Voting System for Visually Impaired Persons Using Arduino Mega 2560," *Bhutan Journal of Research and Development*, 2022.

[2] A. Parmar, R. Joshi, and S. Prajapati, "Secure E-Voting System Using Blockchain Technology and Authentication via Face Recognition and Mobile OTP," in *Proc. 12th Int. Conf. on Computing Communication and Networking Technologies (ICCCNT)*, IEEE, 2021.

[3] R. Govindaraj, S. Vijayalakshmi, and S. Saranya, "Online Voting System Using Cloud," in *Proc. Int. Conf. on Emerging Trends in Information Technology and Engineering (IC-ETITE)*, IEEE, 2020.

[4] P. Sharma, K. S. Shalini, and D. A. Kiran, "Secured Smart Voting System Using Aadhaar," *Int. Journal of Scientific Research in Computer Science, Engineering and Information Technology*, vol. 5, no. 1, pp. 54–59, 2020.

[5] R. Sroa, P. Sachdeva, and N. Sharma, "A Visionary Approach to Smart Voting System," in *Proc. Int. Conf. on Innovative Computing and Communication (ICICC)*, 2021.

[6] N. Indrason, L. Singh, and N. Kshetrimayum, "Blockchain-Based Boothless E-Voting System," in *Proc. ICICC 2020*, Springer, 2021.

[7] N. Sreenivasa, S. Mahesh, and M. Prathima, "Online Voting System by Using Three Step Verification," *ITM Web of Conferences*, vol. 57, 2023.

[8] K. M. Yadav and R. Saini, "Online Voting System," *Annals of the Romanian Society for Cell Biology*, vol. 25, no. 4, pp. 12345–12351,2021.

[9] S. Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," 2008. [Online]. Available: https://bitcoin.org/bitcoin.pdf

[10] R. L. Rivest and W. D. Smith, "Three Voting Protocols: ThreeBallot, VAV, and Random-Sample Voting," in *Proc. USENIX Workshop on Accurate Electronic Voting Technology (EVT)*, 2007.

[11] A. Kiayias, T. Zacharias, and B. Zhang, "End-to-End Verifiable Elections in the Standard Model," in *Proc. IEEE Symposium on Security and Privacy (SP)*, 2015.

[12] M. Volkamer and J. Renaud, *Internet Voting Systems: Security, Usability and Transparency*, Springer, 2017.

[13] N. A. Anuar, N. I. Udzir, and M. A. Maarof, "Securing Online Voting Using Biometric and Mobile Authentication," *Journal of Computer Science*, vol. 10, no. 3, pp. 423–432, 2014.

[14] C. D. Clack, V. Bakshi, and L. Braine, "Smart Contract Templates: Foundations, Design Landscape and Research Directions," *arXiv preprint arXiv:1608.00771*, 2016.

[15] D. Sandler, K. Derr, and D. S. Wallach, "VoteBox: A Tamper-Evident, Verifiable Electronic Voting System," in *Proc. USENIX Security Symposium*, 2008.