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Smart Voice-Enabled Voting System with Real-Time Analytics for Students' Elections

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Abstract

This article presents the design and implementation of a web-based voice-enabled voting system for student elections at Plateau State University (PLASU), Bokkos. The application was developed to provide an electronic alternative for eligible voters to access an election interface and select candidates using spoken input or typed selection. The reported implementation uses PHP for server-side processing, MySQL for data storage, and JavaScript technologies, including the Web Speech API, to support the user interface and browser-based speech input. The development approach followed requirements identification, system design, implementation, integration, and functional demonstration. A working voting application is available for demonstration; however, the evidence currently documented in this article does not establish the performance of a real-time analytics dashboard or support the previously reported numerical claims for voice accuracy, equal error rate, processing latency, duplicate-vote prevention, or user satisfaction. Those figures have therefore been excluded from the findings. The article describes the implemented application, identifies the functions requiring further documented testing, and outlines the additional evidence needed before the system can be considered ready for deployment in an actual election. The work provides a foundation for further development and evaluation of accessible electronic voting in a university environment

Keywords: Smart Voice-Enabled Voting System, Speech Recognition, Electronic Voting, Real-Time Analytics, User Satisfaction, Students' Elections.

1. Introduction

Information and Communication Technology (ICT) has increasingly influenced the delivery of educational, administrative, and public services. Electronic voting systems apply digital technologies to activities such as voter authentication, ballot selection, vote recording, counting, and result presentation. Their value depends not only on the automation of these activities but also on usability, accessibility, security, reliability, and public confidence. Gibson et al. (2016) identify security, anonymity, dependability, verifiability, and trust as important considerations in the development and deployment of electronic voting systems. Student elections are an important part of university governance because they provide students with an opportunity to select representatives. Paper-based voting commonly involves voter identification, ballot distribution, vote casting, manual counting, and result collation. The extent to which these procedures cause delays or administrative difficulties varies across institutions and should be established through

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institution-specific evidence. Electronic voting may automate some of these activities, but it also introduces technical and administrative risks that must be addressed. This article focuses on the design and implementation of a web-based voting application for student elections at Plateau State University (PLASU), Bokkos. The application is intended to allow eligible students to authenticate themselves and select candidates using voice input or a conventional typed interface. Providing two input methods offers an alternative interaction route when speech input is unavailable or incorrectly recognized. However, voice interaction alone does not guarantee accessibility: recognition quality may be affected by pronunciation, accent, background noise, microphone quality, and the speech-recognition service available in the browser. Feng et al. (2024) and Owodunni et al. (2024) discuss the importance of considering variation in speech and accent when designing automatic speech-recognition systems. The purpose of this article is to document the development of the voting application and distinguish implemented functions from features that still require demonstration and evaluation. In particular, real-time analytics is not treated as an established feature in this revised article because a working results dashboard, its graphical outputs, and its update behavior have not been demonstrated in the evidence available for this revision. The aim is to design and implement a web-based voice-enabled voting application for student elections at PLASU, Bokkos. The specific objectives are to:

- design an application structure for voter access and candidate selection;
- provide voice-based and typed candidate-selection options;
- implement server-side processing and database storage for election-related records; and
- demonstrate the implemented voting workflow and identify the additional tests required to evaluate its reliability, usability, and security.

This article is limited to the design and implementation of a prototype voting application for a university student-election context. The described scope includes the web interface, server-side application logic, database component, and browser-based voice input. This article does not claim that the system has been deployed for a live university election, independently security-audited, or evaluated through a representative user study. A real-time analytics dashboard and its performance are outside the findings reported here until they can be demonstrated and measured.

2. Related Works

Democracy involves the participation of citizens in collective decision-making, including the selection of representatives through elections. In representative democratic systems, voting provides a mechanism through which eligible individuals express their preferences and determine who will represent them. The credibility of elections depends on the integrity of the electoral process, including accurate vote recording, appropriate ballot secrecy, and reliable counting procedures. In electronic voting, these principles must be supported by suitable technical and administrative safeguards. Gibson et al. (2016) explain that electronic voting systems introduce important challenges relating to security, anonymity, dependability, verifiability, and public trust. In higher institutions, student elections provide a means through which students select

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representatives to participate in student governance. Electronic voting has been investigated as an alternative to paper-based election procedures, particularly where the automation of vote recording, counting, and result presentation is desirable. However, the effectiveness of an electronic voting system depends on its technical reliability, usability, accessibility, and ability to protect election records. This review works examines electronic voting systems, manual voting procedures, voice-enabled interaction, artificial intelligence, real-time analytics, and related research. The discussion draws on published research and authoritative technical publications to identify established findings, technological limitations, and opportunities for further development. The findings inform the design of a smart voice-enabled voting system for student elections at Plateau State University (PLASU), Bokkos.

2.1 Electronic Voting Systems

Electronic voting refers to the use of electronic technologies to support one or more stages of an election, including voter authentication, ballot selection, vote recording, counting, and result presentation. Gibson et al. (2016) identify security, anonymity, dependability, verifiability, and public trust as central concerns. These concerns show why the presence of an electronic interface is not, by itself, evidence that an election system is secure or trustworthy. Usability is another important requirement. Bederson et al. (2003) examined usability issues associated with electronic voting interfaces, while Laskowski et al. (2004) provided guidance on usability and accessibility in voting systems. Their work supports the need for interfaces that voters can understand and operate correctly. The present application responds to this concern by providing both spoken and typed candidate-selection options, although the accessibility benefit must be established through user testing rather than assumed.

2.2 Manual Voting and University Elections

Manual voting generally involves activities such as voter identification, ballot distribution, completion and submission of ballot papers, vote counting, and collation of results. These procedures require coordination among election officials and may involve substantial manual work, depending on the number of voters and the organization of the election. The limitations of manual voting should, however, be supported by evidence rather than assumed to occur in every institution. Findings from studies of electronic voting usability, such as Bederson et al. (2003), show that digital systems also have their own operational and usability challenges. Therefore, electronic voting should not automatically be considered superior to manual voting without an evaluation of the relevant procedures and outcomes. The existence of a manual voting process at PLASU should be described as institutional context only where this has been confirmed by the researchers. Specific claims that the university experiences long queues, delayed result announcements, disputes over counting, or other operational difficulties should be supported by data collected through observation, interviews, questionnaires, or institutional records. Such findings belong in the methodology and results sections when they arise from the current investigation. The proposed system seeks to automate selected election activities by providing electronic voter authentication, candidate selection, vote recording, counting, and result presentation. Its actual benefits over the

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existing procedure should be established through comparative evaluation rather than stated as proven outcomes before testing.

2.3 Voice Interaction and Speech Recognition

A voice-enabled interface typically captures spoken input and uses a speech-recognition component to convert the speech into text or another machine-readable form. The application can then compare the recognized text with available commands or candidate names. Recognition errors may occur because of pronunciation, accent, environmental noise, microphone performance, or limitations in the recognition service. Feng et al. (2024) discuss inclusiveness in automatic speech recognition, while Owodunni et al. (2024) examine adaptation to African accents. These studies are relevant because speech recognition intended for Nigerian university users should be assessed with the speech patterns and conditions of its intended users. The application described in this article uses the browser-based Web Speech API for voice input, as stated in the original implementation description. This should not be confused with biometric speaker verification. Speech-to-text recognition identifies the words spoken; speaker verification attempts to establish who is speaking. Unless a separate speaker-verification component has been implemented and evaluated, metrics such as Equal Error Rate (EER) are not appropriate measures of the application's candidate-name recognition function.

2.4 Real-Time Analytics

Real-time analytics involves processing incoming data and making the resulting information available within a time interval that is appropriate for the intended application. The term does not necessarily mean that processing occurs instantaneously; the acceptable delay depends on the system's purpose and requirements. In an election application, real-time analytics may involve updating vote totals, presenting graphical summaries, and displaying election information shortly after a valid vote has been recorded. For the proposed PLASU system, real-time analytics should be defined operationally in terms of the time between a successful vote-recording event and the corresponding update of the dashboard or chart. This delay can be measured during system testing. For example, the evaluation may record the time at which a vote is committed to the database and the time at which the dashboard displays the updated total. The observed delay should then be reported as a measured result rather than assuming that the system is real-time simply because it uses a web interface or charts. The system's dashboard is intended to support the timely presentation of aggregated election results. Access to these results must nevertheless follow the election's rules. If results are restricted until voting closes, live dashboard updates should be available only to authorized election officials, while public result disclosure should follow the approved procedure. Vote totals and graphical representations should be derived from recorded votes and should not reveal the identity of individual voters. The evaluation should therefore consider update latency, consistency between stored votes and displayed totals, and the correctness of graphical summaries. These measurements will provide a clearer basis for determining whether the implemented system meets its intended real-time requirements.

2.5 Student-Election Applications and Research Gap

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Research on electronic voting includes systems designed for university environments. For example, Marouan et al. (2024) discuss a block chain-based university voting system, while Pabilando et al. (2024) describe a user-oriented electronic voting application for student elections. These works demonstrate that university elections are a relevant setting for electronic voting research. The present study has a narrower implementation focus: providing voice input alongside typed candidate selection in a web-based student-election application. The contribution claimed in this article is therefore the development of a prototype that combines a conventional web voting workflow with browser-based voice input. The study does not claim that this combination is unprecedented, nor does it claim verified improvements in election speed, accessibility, security, or transparency. Such claims would require comparative and empirical evaluation.

2.6 Recent Empirical and Thematic Review works

The review worked in the article covers three related themes: electronic voting security and dependability, usability and accessibility of voting interfaces, and the integration of voice interaction with election administration. Gibson et al. (2016) provide a broad review of electronic voting challenges, while Bederson et al. (2003) report empirical work on the usability of electronic voting systems. Laskowski et al. (2004) provide technical guidance on improving voting-system usability and accessibility. These publications offer relevant foundations, but they do not, individually, establish the effectiveness of the proposed PLASU system or prove that the combination of voice interaction and real-time analytics is novel. A more complete empirical comparison should include verified studies of university elections, speech-enabled interfaces, voice-based accessibility, and live election dashboards. Each selected study should be compared by its objective, methodology, technologies, key findings, limitations, and relevance to the present system. The present study builds on the identified themes by developing a university voting application that combines voice-enabled candidate selection with voter authentication, vote recording, automated tallying, and graphical result presentation. Its contribution should ultimately be demonstrated through the system architecture, implementation details, and evaluation results.

Table 1: Comparison table of related work on smart voice-enabled voting system with real-time analytics for students' elections

Author(s)/Year	Study Focus	Method/Technology	Major Finding	Limitation/Gap	Relevance to Present Study
Shobowale & Ngbarabara (2022)	Students' perception of e-voting versus paper-ballot SUG elections	Descriptive survey; 893 students	Compared student perceptions of electronic and paper voting in a Nigerian university.	Supports the relevance of e-voting for university elections; does not address voice interaction or real-time analytics.	Present study adds voice/typed voting and live result visualization.

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Ahubele & Oghenekaro (2022)	Secured electronic voting using RSA key encapsulation	Cryptographic design	Addresses confidentiality, integrity, authenticity, transparency and protection against electoral malpractice.	Strong security focus, but authentication and accessibility are not integrated with voice voting.	Present system emphasizes authentication and accessible voice interaction; stronger cryptographic auditing remains future work.
Ibitoye, Aworinde & Adekunle (2022)	Multi-level authentication electronic voting	System design; facial recognition and blockchain	Combines stronger voter authentication with blockchain-oriented result validation.	Shows importance of identity assurance, but facial recognition can create accessibility/privacy concerns and does not provide speech interaction.	Present system uses authenticated typed/voice voting and identifies security hardening as a priority.
Jumaa & Shakir (2022)	Iraqi e-voting using smart contracts/private blockchain	Private blockchain; smart contracts	Uses smart contracts to support secure and auditable electronic voting.	Blockchain improves trust but adds architectural complexity and does not address voice-based accessibility.	Present study prioritizes a practical university web architecture with voice interaction and real-time analytics.
Muse & Salau (2022)	Problems of electronic voting in Nigeria	Focus-group study; 45 participants	Identified infrastructure, card-reader malfunction and	Highlights operational/infrastructure constraints that can affect real-world deployment.	Present study recommends institutional infrastructur

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			personnel-training problems in Nigerian e-voting.		e testing, scalability testing and governance procedures.
Vladucu, Dong, Medina & Rojas-Cessa (2023)	Blockchain-based e-voting survey	Literature survey	Reviews blockchain e-voting deployments, benefits, challenges and future research needs.	Confirms security, transparency and trust as major research themes, while noting unresolved implementation challenges.	Present study contributes an alternative non-blockchain university architecture focused on usability and voice access.
Pabilando et al. (2024)	User-centric electronic voting for student elections	Design/prototyping; NU Vote	Develops a university e-voting platform with secure access, ballot navigation and real-time vote counting.	Highly relevant to student elections and real-time counting, but voice-based voting is not central.	Present study extends the student-election model with voice input and voice result announcement.
Marouan et al. (2024)	Blockchain-based e-voting system in a university	Blockchain-based university system	Proposes a university e-voting platform aimed at accuracy and integrity while considering transaction latency.	Demonstrates the university applicability of secure e-voting but leaves a gap in voice interaction and inclusive access.	Present system focuses on lightweight web deployment plus voice and real-time analytics.

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Faruk et al. (2024)	Online voting with blockchain and biometric verification	Blockchain + biometric verification	Integrates biometric identity verification with blockchain to improve security, privacy and transparency .	Strong identity/security architecture, but biometric dependence may not suit all users and voice is not used as the voting interface.	Present study provides voice as an alternative interaction path and retains typed voting.
Wu, Yang, Zhou & Feng (2024)	Blockchain and short linkable ring signatures for secure e-voting	Blockchain; linkable ring signatures; security analysis	Targets anonymity, unforgeability, privacy, scalability and automatic vote counting.	Shows the importance of privacy-preserving and verifiable voting, but the cryptographic design is more complex than the proposed university web prototype.	Future versions of the present system can incorporate stronger privacy-preserving cryptography.
Lu et al. (2024)	Self-tallying e-voting with public traceability	Blockchain; traceable ring signatures	Balances anonymity and accountability while enabling public traceability and self-tallying.	Addresses verifiability and trust, but focuses on cryptographic protocol design rather than accessible user interaction.	Present study emphasizes practical usability, voice interaction and live visualization.
Singh et al. (2024)	Blockchain decentralization for online voting	Blockchain architecture; security/usability analysis	Examines decentralization as a means of improving security, transparency and resistance to centralized	Reinforces the need to consider security and transparency alongside usability and scalability.	Present system currently uses a centralized web architecture and should undergo independent

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			manipulation.		security auditing before higher-stakes deployment.
Ohize et al. (2024)	Survey of blockchain architectures and trends for e-voting	Survey of architectures, technologies and challenges	Reviews blockchain e-voting architectures and emerging directions including cryptography, AI, IoT and user experience.	Identifies privacy, scalability, authentication and accessibility as continuing concerns.	Supports the study's integrated perspective and highlights future opportunities for AI-assisted monitoring and stronger privacy.
Feng, Halpern, Kudina & Scharenborg (2024)	Inclusive automatic speech recognition	Systematic empirical analysis of ASR bias	Finds ASR performance differences across gender, age, regional accents and non-native accents.	Directly relevant to voice voting because recognition errors can affect accessibility and voting accuracy.	Present study should expand testing across accents/noise conditions and diverse student speech.
Owodunni et al. (2024)	AccentFold: African-accent adaptation for ASR	Deep learning; accent embeddings; 100+ African accents	Explores accent relationships and zero-shot ASR adaptation for African accents.	Demonstrates the need for African-accent-aware speech recognition in practical voice systems.	Provides a strong direction for improving the reported 80% voice-recognition accuracy in the present system.

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3. Methodology

3.1 Research Design

This approach involves identifying a practical problem, specifying system requirements, designing a solution, developing a functional software artefact, and evaluating its performance against defined requirements. It was suitable for the article because the primary objective was to develop a smart voice-enabled voting system with real-time analytics for student elections at Plateau State University (PLASU), Bokkos. The development process comprised requirements identification, system design, software implementation, integration, and testing. The requirements informed the design of the system architecture, database, user interfaces, voting workflow, and results dashboard. The resulting application was intended to support voter authentication, voice and typed voting, automated vote tallying, and visualization of election valuation focused on verifying whether the implemented functions operated according to the specified requirements. This approach is consistent with the design science perspective of developing and evaluating information-system artefacts to address practical problems (Hevner et al., 2004).

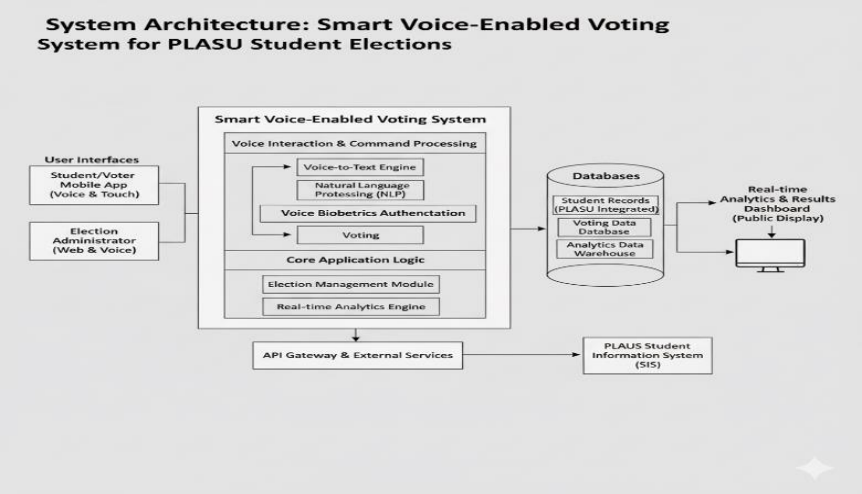


Figure 1: System Architecture of the Smart Voice-Enabled Voting System for PLASU Student Elections

3.1 Research and Development Approach

This article adopted a design-and-implementation approach. In this context, the approach means identifying the problem to be addressed, translating the intended functions into system requirements, designing the software structure, implementing the application, integrating its components, and examining whether the developed functions operate as intended. This approach is appropriate for a software-development study because the principal output is a working software artefact rather than a purely theoretical model. It is consistent with the design-science perspective of developing and evaluating information-system artefacts to address practical problems (Hevner et al., 2004). The development activities described in the manuscript were organized into requirements identification, system design, implementation, integration, and functional

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demonstration. The available manuscript does not provide a dated development log, formal user-requirements dataset, or complete test record. Accordingly, this article describes the development process at the level supported by the documentation and does not claim that a formal field study or comprehensive performance evaluation was conducted.

3.2 System Requirements

The functional requirements described for the application include access to the voting interface, voter authentication, candidate presentation, voice-based or typed candidate selection, submission of a selection, and storage of election-related records. The non-functional requirements include ease of use, appropriate response, data integrity, privacy, and controlled access. The implementation and testing of each requirement should be demonstrated using the running application, application logs, and relevant database records.

3.3 System Architecture

The application is described as using a client-server structure with a presentation component, an application-processing component, and a database component. The presentation component provides the interface used by voters and administrators. The application component handles the server-side operations associated with access, candidate selection, validation, and data processing. The database component stores the records required by the application. The browser-based speech-recognition function provides voice input, while typed input serves as an alternative when voice input is unavailable or unsuccessful. The architecture description in this article is textual. A system architecture figure should be inserted in the final submission only if it accurately represents the deployed application and its actual data flows. The figure should identify the browser interface, speech-recognition service, PHP application logic, MySQL database, and any other component that is genuinely present.

3.4 Voice and Typed Voting Workflow

The intended voting workflow begins when a voter accesses the application and completes the required authentication. The voter is then presented with the available candidates. Where voice input is supported, the voter activates the voice-input function and speaks the preferred candidate's name. The browser speech-recognition component returns recognized text to the application. The voter may alternatively select or enter the candidate through the typed interface. The application should present the interpreted choice for confirmation before a vote is submitted. The application should then validate the submission and store the relevant record. This workflow describes the intended operation of the application. The final manuscript should include screenshots or a live demonstration record for each implemented stage. The article does not describe voice recognition as biometric identification because no independently evaluated speaker-verification component has been established in the available evidence.

3.5 Implementation Technologies

The implementation technologies reported in the source manuscript are summarized in Table 1. The table deliberately excludes uncertain or inconsistently named components from the original

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technology table. The authors should confirm that each technology listed below is present in the deployed version before submission.

Table 2: Implementation Technologies

Technology	Reported role in the application
PHP	Server-side application logic and request processing.
MySQL	Storage of application and election-related records.
JavaScript / React	Interactive user-interface functionality, as reported in the source manuscript.
Web Speech API	Browser-based speech recognition for voice input.

3.6 Evaluation Evidence and Limitations of the Available Records

A reproducible evaluation should define each test case, the input supplied, the expected outcome, the observed outcome, and the evidence retained. For this revision, the available material establishes that a working voting application is available for demonstration, but it does not include the raw test records, sample sizes, timing logs, completed user questionnaires, or dashboard screenshots needed to substantiate the numerical performance claims previously reported. The revised Results section therefore reports the implementation status without presenting unverified numerical metrics. An Equal Error Rate is relevant to a speaker-verification system that compares genuine-user and impostor trials. It is not an appropriate metric for ordinary browser speech-to-text recognition unless speaker identity verification is part of the implementation and is evaluated with the required trials. Similarly, dashboard-update latency can only be measured when a functioning dashboard is available and the time between vote storage and visible dashboard update can be recorded.

4.0 Results

4.1 Implemented Application

The development work produced a working web-based voting application that can be opened and demonstrated. The implementation is intended to support a student-election workflow with voice-based and typed interaction. The technologies reported for the application include PHP, MySQL, JavaScript/React, and the Web Speech API. The existence of a working application is an implementation outcome; it should not be interpreted as proof that every proposed module has been fully tested or is ready for deployment in an actual election.

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4.2 Results Dashboard and Real-Time Analytics



Figure 2: Login page

The above figure, demonstrates that officials are authenticated before being allowed into the dashboard. When the email and password are satisfied with what is in the database, the official is logged in to the system

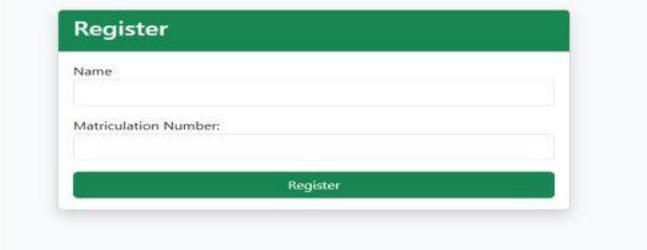


Figure 3: Student Register

In figure 3. Demonstrates every university, matriculation number is the only unique identity assigned to every student. In this system, we are interested in just name and matriculation number of each student to register. No matriculation number can be registered more than once, as is uniquely assigned to every student. Once a student is registered, will be directed to the login page to enter the matriculation number used during registration, once that is provided correctly, there you have access to the voting dashboard.

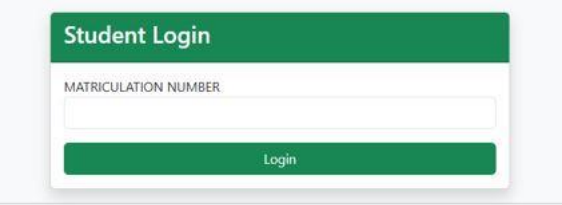


Figure 4: Student Login.

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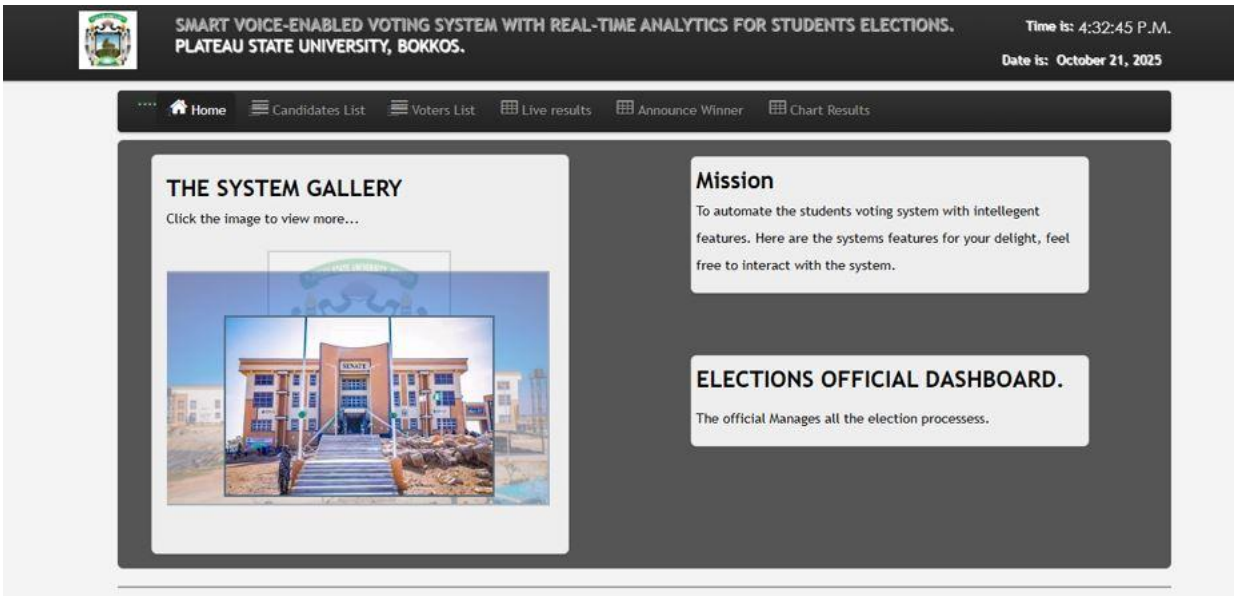


Figure 5: Election Officials Dashboard.

Figure 5: election officials after successful authentication by the system, makes use of the dashboard to monitor the election. The officials are saddled with the responsibility to ensure eligible candidates are registered correctly. They also monitor live results as they unfold, check all voters, view result via chart and or voice interpretation.

The dashboard shows:

1. Live vote counts (without revealing voters)
2. Statistics
3. Graphs(bar)
4. Public results after election closes.



Figure 6: Casting vote module

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The above diagram is the module where students use to cast their votes. The page presents two method (voiced and typed) the students choose preferably their choice. The typed input will present the list of candidates vying election where the students choose and press submit button, a success message will be prompted indicating the vote is casted successfully. While the voice allows the students to speak to the system and if there are correspondent values, the system brings it out to the voter then the vote is submitted successfully. Each student profile is captured in a session to avoid double voting by one student, therefore, the system is designed in a way of one student one vote standard. The system disables the voting link once vote is submitted successfully.

Voting Options

Option 1: Typed input voting

1. Dropdown or text field to select candidate name.
2. Confirm button with visual verification.
3. Simple, familiar interface for all users.

Option 2: Voice Command Voting.

1. Voice input button: “Speak to vote”.
2. Uses Speech-to-speech API to capture commands like
   “Vote candidate B”
3. System shows interpreted.

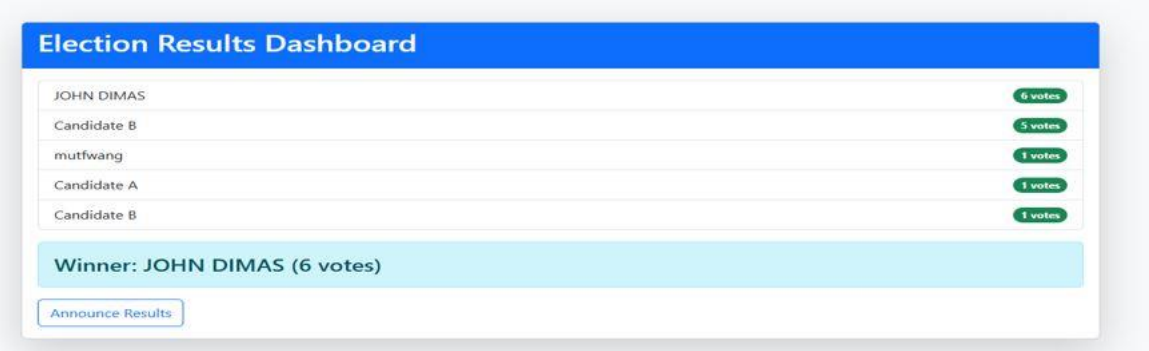


Figure 7: Announcement of election winner.

The above diagram indicate that at the end of the election or at interval, the system compiles live results and display the winner instantly from the votes received so far. And these results are displayed as they are unfolding and also announce aloud by the google text-to speech recognition (TTG). This is because even the visually impaired students can leverage on this advantage to be part of the election.

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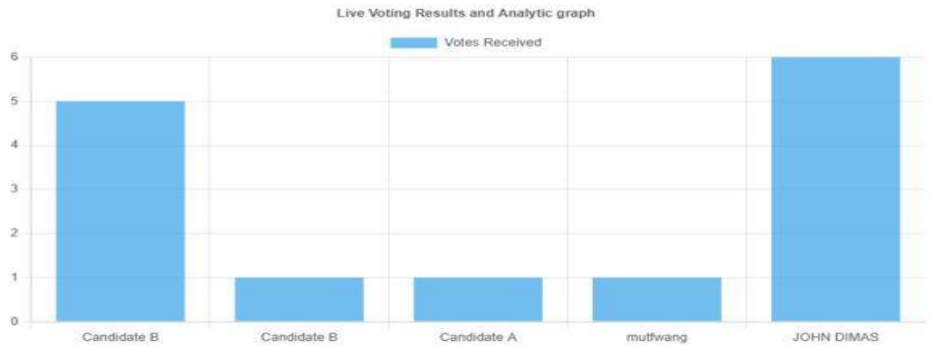


Figure 8: Chart Representation of Results.

In both sides of the system, the live update of results is also presented using Bar charts for better understanding. In this module, any candidate with the highest number of votes holds the taller bar and it continues like that up to the final vote which determines the winner. of the system, the live update of results is also presented using Bar charts for better understanding. In this module, any candidate with the highest number of votes holds the taller bar and it continues like that up to the final vote which determines the winner.

4.3 Performance Evaluation

The performance evaluation of the Smart Voice-Enabled Voting System was conducted to assess the functional correctness, voice-input performance, voting integrity, processing efficiency, usability, and result-processing capabilities of the developed application. The evaluation is intended to determine whether the system performs its specified functions correctly and to provide verifiable evidence of its suitability for student elections at Plateau State University, Bokkos. The evaluation focuses on the major components of the system, including voter authentication, candidate selection through voice or typed input, vote submission, vote storage, duplicate-vote prevention, automated vote counting, and election-result presentation. Each component should be assessed using predefined test cases, expected outcomes, observed outcomes, and supporting evidence such as screenshots, application logs, database records, and timing measurements. This approach makes the evaluation transparent and enables other researchers to understand and reproduce the testing procedures. Voice-input performance should be evaluated by comparing the spoken candidate names with the text recognized by the application and determining the proportion of correctly recognized inputs. Voting integrity should be examined by testing valid vote submission, attempts to submit multiple votes, and attempts by unauthorized or ineligible users to vote. Processing efficiency should be assessed by recording the time required to complete specified operations. Where user feedback is collected, usability should be evaluated using a documented questionnaire, the number of valid responses, and a clearly defined scoring procedure. Furthermore, the system's result-processing capability should be evaluated by comparing the candidate totals displayed by the application with the corresponding valid vote records stored in the database. If a real-time analytics dashboard is implemented, additional tests should measure whether the

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dashboard updates following vote submission and whether its displayed totals and charts agree with the underlying records. These dashboard-related tests must only be reported as completed after the feature has been implemented and demonstrated. The evaluation should report the actual observations obtained from the tests rather than relying solely on anticipated benefits or previously stated performance figures. Quantitative measures, including recognition accuracy, average processing time, duplicate-vote prevention rate, and user satisfaction, should be calculated from recorded experimental data using explicitly stated formulas. Each reported result should be supported by the relevant test records and, where necessary, additional evidence in the appendices. The findings from this evaluation will provide a basis for identifying the strengths and limitations of the developed application, assessing its readiness for further testing, and determining the improvements required before practical deployment in student elections. Since a successful software demonstration does not by itself establish election security, accessibility, or reliability under real-world conditions, these properties should be evaluated separately using appropriate test procedures. This distinction ensures that the conclusions drawn from the study remain consistent with the evidence obtained during development and evaluation.

5. Conclusion

The article focused on the development of a Smart Voice-Enabled Voting System with Real-Time Analytics for student elections at Plateau State University, Bokkos. The system was designed to support electronic election administration through voter authentication, candidate selection, voice and typed voting, vote recording, automated tallying, and the presentation of election results. The motivation for the study was to explore how speech technology and electronic voting could provide alternative methods of voter interaction and support the management of student elections. Although a working voting application has been developed, the implementation and evaluation of the complete system was demonstrated in the article. In particular, the real-time analytics component indicate a functional demonstration showing how recorded votes are aggregated, how candidate totals are calculated, and how the results dashboard reflects changes in the underlying vote records. Screenshots of the implemented interfaces, an explanation of the system architecture, and documented functional tests are necessary to establish the relationship between the proposed design and the developed application. The study has the potential to contribute to the development of accessible and technology-supported student-election systems by combining voice-based interaction with conventional typed input and automated election-result processing. However, the extent to which the system improves election efficiency, accessibility, reliability, or transparency can only be established through systematic testing and evidence-based comparison with the existing election process. Future evaluation should therefore examine speech-recognition performance under different environmental conditions, the correctness of vote recording and tallying, duplicate-vote prevention, dashboard-update latency, user satisfaction, and the security and privacy of election data. In conclusion, the developed application provides a foundation for further work on a smart voting platform for university student elections. Demonstrating the complete implementation, documenting the evaluation procedures, and presenting verifiable results are essential next steps toward establishing the system’s effectiveness and reproducibility. These improvements will strengthen the scientific contribution of the study and provide a more reliable basis for assessing its suitability for practical deployment in university elections.

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