

STUDENTS ONLINE VOTING SYSTEM

CASE STUDY: ROCK HIGH SCHOOL TORORO

By

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AUGUST, 2026.

DECLARATION

I, **BYAMUKAMA JOEL**, with registration number BU/UP/2023/1507 hereby declare that this project report is original and has not been published or submitted for any other degree award to any other university before.

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APPROVAL

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DEDICATION

I thank the Almighty God who successfully enabled me to complete with a sound mind and good health. I then dedicate this report to my inspirer of all times my father **KIIZA TIMOTHY**. I also appreciate my lovely mother **KABAROKOLE FELESTA** who have been putting me in their prayers. Thank you so much for the support and may the Almighty God reward you abundantly.

Special thanks to my dear supervisor **MR. KISANGALA GERALD** who guided me on the dos and don'ts passed on making this report a success. For if it was not him, maybe I would not shoot the tip of this mountain.

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Table of Contents

DECLARATION	ii
APPROVAL	iii
DEDICATION	iv
ACKNOWLEDGEMENT	v
LIST OF FIGURES	ix
ABSTRACT	1
CHAPTER ONE: INTRODUCTION	2
1.1 Background of study	2
1.2 Problem Statement	2
1.3 Main Objective	3
1.4 Specific Objectives	3
1.6 Significance of Study	4
1.7 Scope of the study	4
1.7.1 Content Scope	4
1.7.2 Technological Scope	4
1.7.3 Geographical Scope	5
1.7.4 Time Scope	5
CHAPTER TWO: LITERATURE REVIEW	6
2.1 Introduction	6
2.2 Student Online Voting System	6
2.3 Online Voting System for Tertiary Institution	7
2.4 An Online Voting System: A Case Study of Uganda Martyrs University	8
2.5 A Practical, Secure, and Auditable E-Voting System	10
2.6 College Community Online Voting System	11
2.7 Features of Electronic/ Students Online Voting Systems	13
2.8 Benefits of Automated Web-Based Voting Systems	13
CHAPTER THREE: METHODOLOGY	15
3.1 Introduction	15
3.2 Research design	15
3.3 Area of study	15
3.4 Population and sampling method	15
3.5 Data collection methods and analysis	16

3.6 System development.....	16
3.7 Design.....	17
3.8 Implementation	18
3.9 Testing and validation	19
3.10 Ethical consideration	20
CHAPTER FOUR: FIELD STUDY AND SYSTEM DESIGN.....	21
4.1 Introduction.....	21
4.2 Background information of the current system.....	21
4.3 System Study and Analysis.....	22
4.3.1 Findings from interviews and questionnaires	22
4.4 User Requirements.....	25
4.4.1 Functional Requirements	25
4.4.2 Non-Functional Requirements	26
4.5 Hardware/ software requirements.....	27
4.6 System Design.....	27
4.6.1 The system architecture.....	27
4.6.2 Context Diagram (Level 0 DFD)	29
3.8.2 Context Diagram.....	29
4.6.4 The Use Case Diagram.....	34
CHAPTER FIVE: IMPLEMENTATION AND TESTING	40
5.0 Introduction.....	40
5.1 Interface Design	40
5.1.1 Landing Page.....	40
5.1.2 Login Pages.....	41
5.1.3 Admin Dashboards	41
5.1.5 Voter Accounts	43
5.1.6 Voter Dashboard	44
5.2 Data Storage	44
5.2.1 User Table.....	44
5.2.2 Student Table	45
5.2.3 Position Table	45
5.2.4 Candidate Table	45
5.2.5 Vote Table.....	45

5.2.6 Election Table.....	45
5.3 System Testing.....	45
5.3.1 Unit Testing	45
5.3.2 Integration Testing.....	45
5.3.3 Functional Testing.....	46
5.3.4 User Acceptance Testing.....	46
5.3.5 System validation	46
6.1 Discussion	47
6.2 Conclusion	49
6.3 Recommendations	50
6.4 Limitations and Future Work	51
REFERENCES	52

LIST OF FIGURES

Figure 1: Rapid Application Development Process.....	17
Figure 2: System architecture	27
Figure 3: Context diagram	29
Figure 4: Data Flow diagram	31
Figure 5: Use case diagram.....	34
Figure 6: Entity Relationship Diagram (ERD)	36
Figure 7: Landing page	40
Figure 8: Login Page.....	41
Figure 9: Administrator Dashboard	42
Figure 10: Student Dashboard	43
Figure 11: Voter Accounts.....	43
Figure 12: Voter Dashboard.....	44

LIST OF TABLES

Table 1: participants.....	16
Table 2: Student Table	37
Table 3: Student Table	37
Table 4: Candidate Table	38
Table 5: Vote Table	38
Table 6: Election Table	38

LIST OF ACRONYMS

API - Application Programming Interface

CSS - Cascading Style Sheets

HTML - Hypertext markup language

HTTP - Hyper Text Transfer Protocol

HTTPS - Hyper Text Transfer Protocol Secure

JSON - JavaScript Object Notation

PWA - Progressive Web Application

RAD - Rapid Application Development

RDBMS - Relational Database Management System

MySQL - My Structured Query Language

SSADM - Structured Systems Analysis and Design Methodology

ABSTRACT

The traditional manual, paper-based student electoral process at Rock High School, Tororo, is inefficient, time-consuming, and prone to errors such as ballot loss, voter impersonation, and lack of transparency. This leads to long queues for students and challenges in record management, fairness, and monitoring for administrators and the electoral commission.

This study designed and implemented a Web-Based Online Voting System to enhance efficiency, transparency, and security. Drawing on existing systems, it enables students to register, view candidate profiles, vote digitally from any location, and access real-time results. Electoral commission members manage the process via dedicated dashboards, while administrators oversee operations, generate reports, and manage accounts.

A mixed-methods approach (interviews and questionnaires) gathered requirements from administrators, teachers, and students. The system was developed using the Rapid Application Development (RAD) approach within the Structured Systems Analysis and Design Methodology (SSADM) framework, implemented with XAMPP, PHP, MySQL, HTML, CSS, and JavaScript.

Testing (unit, integration, functional, and user acceptance) confirmed improved efficiency, reduced voting time, and higher user satisfaction. The system effectively addresses the limitations of the manual process and supports digital transformation in school administration and student democracy. Future work should include commercial cloud hosting and development as a Progressive Web Application (PWA) for better mobile access.

CHAPTER ONE: INTRODUCTION

1.1 Background of study

Student elections help learners develop democratic participation, leadership, and accountability. Traditional paper-based methods require extensive preparation, printing, and manual counting, making them time-consuming and prone to errors.

Electronic voting can simplify administration, speed up counting, and improve convenience, but raises concerns about security, privacy, and voter confidence. Examples from Helios Voting, Kabarak University, the University of Nairobi, Tanzanian secondary schools, and Ugandan institutions (including Ndejje University, Naalya Secondary School, and Trinity College Nabbingo) show that electronic student elections are feasible.

However, many Ugandan secondary schools face significant infrastructure constraints: only about half have reliable electricity throughout the day, more than one-third lack internet, and device access is limited (roughly one device per 63 students). Complex online systems that require continuous connectivity or personal devices are therefore often impractical.

This creates a research gap for simple, context-specific systems designed for supervised computer-laboratory voting. The study addresses this gap by developing an online voting system for Rock High School, Tororo. Students will log in using admission numbers and temporary PINs; teachers or administrators will manage the process through a dashboard. The system will prevent multiple voting, monitor turnout, securely record votes, automatically tally results, and generate timely reports, offering an affordable, user-friendly alternative to traditional paper ballots.

1.2 Problem Statement

Free, fair, and efficient student elections are important for developing leadership, democratic values, and trust in school governance. At Rock High School in Tororo, elections are still conducted using paper ballots and manual counting. This process is time-consuming, prone to errors, delays, and limited transparency, and places a heavy burden on teachers.

Although the school has a computer laboratory, it is not used for elections. Existing electronic voting systems do not adequately meet the needs of resource-constrained secondary schools that

require simple, supervised computer-lab voting with appropriate student authentication and immediate results.

There is therefore a need for a simple, secure, and context-appropriate online voting system. Students will vote using their identification numbers and temporary PINs, while teachers will manage elections through a dashboard. The system will prevent multiple voting, monitor turnout, automatically tally votes, and produce timely results improving efficiency, accuracy, and transparency in student elections at the school.

1.3 Main Objective

To develop Students Online Voting System for Rock High School that will enable centralized and secure platform for managing Students elections to enhance the accuracy, transparency and efficiency of the election outcomes.

1.4 Specific Objectives

- 1) To review literature and determine requirements for Students Online Voting System
- 2) To analyze the requirements and design the system to be developed
- 3) To develop an Online Students Voting System
- 4) To test and validate the system for usability and reliability

1.5 Research Questions

- 1) Which key challenges, best practices and gaps in the existing Students Voting Systems are identified in the literature relevant to secondary school elections.
- 2) What specific functional and non-functional requirements must the system address for students and teacher supervisors (Administrators).
- 3) How can a fully functional, secure students online voting system be implemented to support supervised laboratory voting at Rock High School.
- 4) To what extent is the implemented system functional, secure, and usable for students and teachers (Administrators).

1.6 Significance of Study

In modern educational environments, adopting digital systems is essential for improving operational efficiency and transparency. Implementing an Online Voting System at Rock High School will address challenges associated with manual elections, such as delayed vote counting, ballot mismanagement, and limited transparency.

Research indicates that digital voting systems improve accessibility and reduce administrative workload by automating election processes. The proposed system will enable students to participate in elections electronically, increasing participation and minimizing disruptions to academic schedules.

Automated vote tallying will eliminate human errors and provide instant results, enhancing trust in the electoral process. Additionally, the system will simplify election management by providing tools for candidate registration, voter authentication, and result reporting. This will promote fairness, transparency, and digital literacy within the school environment.

1.7 Scope of the study

The scope provides for the boundary of the research in terms of depth investigations, content, And methodology, geographical, technological and theoretical coverage.

1.7.1 Content Scope

The study will focus on developing an Online Voting System that supports student elections such as prefects, student council leaders, and club representatives. Core functionalities will include voter authentication, candidate management, ballot casting, vote counting, and result reporting.

The research will also examine usability, transparency, and security considerations associated with digital voting in secondary schools.

1.7.2 Technological Scope

The system will be developed using HTML, CSS, and JavaScript for the frontend interface, while PHP will be used for backend processing. MySQL will serve as the database for storing voter information, candidate profiles, and election results.

Security measures such as password authentication, access control, and encrypted data storage will be implemented to ensure election integrity.

1.7.3 Geographical Scope

The system will be implemented at Rock High School and will be accessible within the school environment.

Students will primarily cast their votes using computers in the school computer laboratories to ensure supervision and system security. Conducting voting within a controlled environment reduces risks such as unauthorized access and identity misuse. However, the system will be designed with scalability in mind, allowing future integration of remote voting capabilities once adequate security infrastructure is established.

1.7.4 Time Scope

The development and implementation of the Online Voting System took approximately 2 months, including requirements gathering, system design, development, testing, and deployment.

An additional evaluation period will allow for user feedback and system improvements.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This literature review examines existing research and implemented systems related to web-based voting management systems. The review synthesizes findings from multiple studies conducted across various educational institutions, focusing on the challenges of manual voting systems and the benefits of automated online voting solutions.

2.2 Student Online Voting System

(Makungu et al., 2018) developed a Student Online Voting (SOV) system that provides online voters registration forms for students where students register and are allowed to log in as either students or delegates or candidates. Each registered user has a password to log in. The system provides an interactive platform where voters and candidates interact and thus candidates perform their campaigns. The system allows preliminary voting and the results are graphically represented in percentage. This system also allows the candidates to be liked by users and the most liked candidate is the most popular. The system computes and gives the election results for all the posts and provides reports for the whole election process.

The study identified that in the previous elections, there have been challenges in the turnout of voters due to some challenges they face on the voting day. Initially the students were expected to queue and cast their votes in the ballots as per their various schools. The current system does not verify and account for the persons to vote since no voting registration is done prior. This has been bringing some loopholes in that even a student who is not in session can queue and vote as long as he/she has a student identification Card. The current system does not also tell the number of expected voters since they rely on the population of the student of which not all students are interested in these elections.

The authors noted that candidates are expected to reach voters through campaigns of door to door, rallies and debates which has been a challenge for a while due to the busy environment in the school. Many students do not attend rallies because of their busy schedules and also, it's hard for candidates to find students in their houses since availability is an issue. This mode of campaigning has been yielding less fruits and thus voters would cast votes with either no or less knowledge

about the candidates and their manifestos. When it gets to counting, a lot of time and manpower is consumed.

The methodology used was waterfall with implementation carried out using HTML, JavaScript, PHP for the web platform with MySQL as the database. The study concluded that the system allows users to sign up and therefore log in to interact with the system. The system allows the students, delegates and candidates to interact virtually with each other. The system also enables delegates to do the preliminary voting and even voting online and the results are displayed for all users to view. The system allows every user to like the candidates of their preferences and the most liked candidate is the most popular. The system is able to compute reports for the whole election process.

2.3 Online Voting System for Tertiary Institution

(Mbamala, 2022) proposed an online voting system which is a paperless form of voting that will meet the electoral needs of the student union government. The study noted that violence, defacing and littering of institution's environment during student union election campaign have been the problem faced by manual system of voting in institutions. The proposed system harnesses and utilizes the immense power of ICT techniques to create a striking impact in the way electoral activities are being conducted in Nigerian institutions. The goal of the system is tailored at establishing an efficient and effective electronic voting system aimed at improving students' government democracy, and reducing electoral irregularities and malpractices in students' union elections.

The study identified that gathering of students to participate in student union election has been a continual challenge for student's union government in Nigeria tertiary institutions and also to the University management because of insecurity, violence in election and moribund associated with campaign. This is as a result of the fact that election in most Nigeria tertiary institutions use manual secret ballot voting system, which holds on a single voting location where the electorates need to be physically available. This voting system is problematic as it triggers election crisis, it is inconvenient and susceptible to error and time consuming. Electoral results can easily be manipulated or altered; the electorates and electoral officers can easily be induced to act against their will. The system is not friendly to physically challenged electorates. It does not ensure security of voters and votes. It encourages multiple voting and very much error prone since vote's

collation, votes counting and results compilations are done manually by humans. Institution environment and walls are being littered with posters and fliers.

The author further noted that student politics, campaign and voting can be very tense and divided among ethnic and religious groups line, just like the national politics. Several cases of student election violence have been recorded across the globe with number of cases in Nigeria. This is often triggered by gathering together to vote and also by various forms of malpractice and rigging.

The platform provides the following features: efficient voting interface which will enable electorates to vote at their comfort zone, campaign and manifest page which will enable contestant to campaign online, upload their manifest, answer questions that might crop up from students who think they are incompetent and also save the institution environment, walls from being littered with posters and fliers and moribund associated with campaign, instant result generation, improved security, and online registration.

A six-step prototyping model was used for the development of this application. The phases of the development model included: requirements gathering, quick design, prototype building, user evaluation, refining prototype, and implementation and maintenance. The system was developed using MYSQL and HTML and tested using WAMP server together with PHP.

2.4 An Online Voting System: A Case Study of Uganda Martyrs University

(Kamya, 2017) conducted a study on an online voting system using Uganda Martyrs University as a case study. The purpose of this study was to develop an online voting system that would ease the process of voting at Uganda Martyrs University. The study noted that the current system is manual and requires students to move to the polling station in order to cast their vote. In this process, the students have to provide their initials to the voting officials at the polling stations and once provided, the voting officials verify the information provided and the students are given ballot papers in order to complete the process of voting. This process is time consuming and tiresome. The online voting system therefore provides an easier way of voting that does not require one's physical presence in order to cast their vote.

The study identified that in Africa, so many organisations are still using ballot papers to cast their votes which has been so much affected by time hence leading to long queues. This method arises with some problems such as walking of long distances for people to cast their votes and insecurity

for example in counting of the final result among other problems. In Uganda, online political voting has not been tested in any political field but in steady generally online voting have been tested in other fields such as Bet Awards through sending text, WhatsApp and E-mail messages among others. Still in Uganda, there is a digital divide that is to say, the difference between the haves and have notes. Studies show that those who are young and more affluent have better computer knowledge than those who are less affluent and educated.

The problem statement identified that internet technologies and the new inventions introduced a new trend on how different sectors perform, the voting sector was one of the areas that these inventions were integrated where by proponents now cast their votes online in different countries using home based computers and internet kiosks. However, due to poor network, lack of enough computers and low literate rate of people about computers in Uganda Martyrs University, the voting process which needs to be integrated to online due to the challenges faced in the physical voting like long queues, harsh climate, mistreating opponents by opposition time wasting during votes counting among other factors and insecurity problems, the computer based online voting system was looked at as the way that would support online voting in the developing institutions.

The system analysis identified that the current system is manual with weaknesses including being subject to human bias that can tamper with the true electoral results, lack of convenience since it requires physical presence at the polling center in order for one to cast a vote, and presents a higher likelihood of low voter participation. User requirements included easy to use graphical user interface that would enable users to interact with the system and a secure and well configured database as back end. Functional requirements included that the electoral committee should be able to add voter card numbers and names of voters into the voters' sub-system, the system should enable voter to vote, the system should process and display election results, and the EC should be able to monitor all submissions as they happen. Non-functional requirements included reliability, multi-threading, usability, and availability.

The system was developed using the Rapid Application Development (RAD) model with development tools including Windows 8 Operating system, Adobe Dreamweaver, PHP, and MySQL. The study concluded that from a proper analysis and assessment of the designed system, it can be safely concluded that the system is an efficient, usable and reliable online voting system. It is working properly and adequately meets the minimum expectations that were set for it initially.

2.5 A Practical, Secure, and Auditable E-Voting System

(AboSamra et al., 2017) proposed a cryptographic electronic voting system to replace the conventional voting methods, which are widely used in most developing countries in the Middle East and North Africa (MENA) region. The proposed e-voting system is based on the concept of Pret a Voter, which is a paper ballot e-voting scheme. The proposed e-voting scheme eliminates the need for anonymous channels to anonymize the votes in Mixnet based e-voting schemes, yet provides comparable level of security and vote anonymity with less system complexity. The proposed e-voting scheme uses paper ballots, due to its familiarity among the public, but with strong cryptographic algorithms with proven security features, to provide enhanced level of ballot secrecy, verifiability and security. The proposed scheme is simple, secure, practical, and auditable.

The study noted that traditional voting systems have been developed to ensure that the principles required for democratic elections and referendums are met, namely the guarantee of the freedom to vote, the secrecy of the vote, the non-modification of the expressed intention of the vote, and lack of intimidation and coercion during the vote process. It is essential that these principles are not undermined by the introduction of new voting methods. E-voting is the term used to refer to the act of voting using electronic systems to cast and count votes in elections. Forward-thinking countries and election commissions are very motivated to explore how it can help them improve their elections. For some nations, automated elections mean that people can trust the results because it allows for a process that is so auditable, transparent and secure. Of course, e-voting also helps reduce human error. E-voting is very good at making voting more accessible, meaning it's easier for disabled people to vote independently.

The authors identified that the conventional elections methods suffer from many drawbacks including long period of preparation, fake and faulty voting, mistakes in count of votes, long period of votes counting, and high cost of the election process. Despite that, these conventional election methods are still being used in the developed and developing countries. Nowadays, Information and Communication Technologies (ICT) are being introduced in various stages of the electoral process. Electronic voting introduced ICT to the election process in order to increase the possible benefits such as speed release of election results and ease of voting. Electronic voting aims to decrease the time needed for vote casting and vote counting, to reduce the cost of the election process, and to improve the accuracy of the results.

An e-voting scheme is expected to satisfy certain general security requirements determined by the application, and also some specific requirements related to system's implementation. To be considered secure against adversarial attacks, an e-voting scheme must also satisfy additional security requirements. These requirements may be divided into voter related, scheme related, and system related requirement. Voter related requirements include eligibility, authentication, uniqueness/non reusable, privacy, convenience, transparency, and walk away. Scheme related requirements include dispute freeness, fairness, non-coerce-ability, and practicality. System related requirements include soundness, accuracy/completeness, integrity, reliability, robustness, flexibility, auditability, Certifiability, cost effectiveness, voter mobility, receipt freeness, verifiability, verifiable participation, efficiency, and scalability.

The study identified the main problems of the conventional paper-based voting method in developing countries as illiteracy (in both computer and basic reading and writing), accuracy of election results, communication infrastructure, lack of verifiability, integrity of voting sheets, loss of votes, human resources, and voters' turnout. The authors concluded that the research proposal has the potential to be deployed as a trustworthy e-voting system to replace the conventional voting methods in developing countries.

2.6 College Community Online Voting System

(Zakaria & Safawee, 2025) examined the creation and execution of a College Community Online Voting System, aimed at modernising the election process in academic institutions through the use of digital technology to improve participation, security, and administrative efficiency. The main aim of this system is to offer a seamless, accessible, and secure platform for executing diverse voting activities, such as student elections, faculty surveys, and decision-making procedures. Through the resolution of the drawbacks associated with conventional paper-based voting, including difficulties with administration, vulnerability to fraud, and restricted accessibility, this technology seeks to enable a more equitable and effective voting process.

The study noted that voting methods have come a long way, from counting hands to using paper ballots, punch cards, and electronic machines. Modern electronic voting systems offer benefits like better accuracy, convenience, flexibility, and mobility. However, these systems also have some issues, such as taking a lot of time, requiring a lot of paperwork, lacking direct oversight, and having problems like machine damage or difficulties with updating multiple items at once. An

Online Voting System can address these problems. It allows voters to cast their votes from anywhere in the country without having to go to a polling booth. This secure method of voting helps reduce the risk of violence and is likely to increase voter turnout.

The literature review identified that the integration of online voting systems into college communities represents a significant evolution in democratic participation within educational institutions. By shifting from traditional paper-based voting to electronic platforms, colleges and universities can offer a more accessible, efficient, and secure way for students to engage in decision-making processes. The use of online voting systems in colleges and universities has been linked to an increase in voter participation, particularly among younger voters who are more accustomed to digital technologies. Research suggests that implementing an online voting system within a college community can improve accessibility and convenience, encouraging more students to engage in elections and referendums. Furthermore, online platforms enable students who are off-campus or have limited availability to cast their votes without having to physically attend voting booths, thereby removing barriers to participation.

The study highlighted that while online voting systems offer numerous benefits, they also pose significant security and privacy challenges. Ensuring that votes are cast anonymously and securely, without the possibility of manipulation or fraud, is critical for maintaining trust in the system. The literature on e-voting highlights several security measures designed to protect the integrity of the voting process including encryption, digital signatures, and end-to-end verifiable voting protocols. Any online voting system must be designed with a strong focus on security, emphasizing the importance of verifiable secret-ballot elections, where voters can confirm that their vote was cast correctly without revealing their choice to anyone else.

The project involves developing a web-based application that includes characteristics necessary for a democratic voting process, such as secure user authentication, real-time vote tracking, and robust data protection methods. The system utilises sophisticated cryptographic methods and stringent security rules to guarantee the integrity and confidentiality of each vote, alleviating concerns regarding data tampering and unauthorised access. The system's efficacy and user-friendliness have been demonstrated through a pilot implementation in a college context, which has resulted in significant improvements in administrative workflow and voter engagement.

2.7 Features of Electronic/ Students Online Voting Systems

Based on the literature reviewed, the following are key features of effective electronic/online voting systems:

1. Online Voter Registration: Students can register to vote digitally using their student ID and other verifying details (Makungu et al., 2018; Mbamala, 2022).
2. Role-Based User Modules: Different interfaces and permissions for students, electoral commission members, and system administrators (Kamya, 2017; Makungu et al., 2018).
3. Secure Authentication and Authorization: Users must log in with unique credentials to ensure only eligible voters can participate (Kamya, 2017; Mbamala, 2022).
4. Real-Time Status Tracking: Students can log in to monitor their voting status and election progress without physical presence (Zakaria & Safawee, 2025; Kamya, 2017).
5. Candidate Profiles and Manifestos: Candidates can present their manifestos and qualifications to voters through online profiles (Makungu et al., 2018; Mbamala, 2022).
6. Online Voting & Automated Counting: Students vote online, and the system automatically counts votes and generates results (Mbamala, 2022; Zakaria & Safawee, 2025).
7. Reporting & Analytics: Generation of reports on voter turnout, election results, and audit trails of user activities (Kamya, 2017; Makungu et al., 2018).
8. Security Features: Role-based access control, data encryption, and secure login credentials to protect sensitive student data (AboSamra et al., 2017; Zakaria & Safawee, 2025).
9. Instant Result Generation: Results are displayed immediately after the voting period ends (Mbamala, 2022; Kamya, 2017).
10. Interactive Platform: Students and candidates can interact virtually, allowing candidates to campaign and answer questions online (Makungu et al., 2018).

2.8 Benefits of Automated Web-Based Voting Systems

Automated web-based voting systems provide significant improvements over traditional manual systems. Makungu et al. (2018) noted that online voting offers speed and convenience, generating results instantly after the election than conventional methods of manual voting. The system allows

users to interact virtually with each other and enables voting online with results displayed for all users to view.

Mbamala (2022) identified that online voting systems generate efficient voting interfaces enabling electorates to vote at their comfort zone, provide campaign and manifest pages for candidates to campaign online, instant result generation, improved security, and online registration. The goal of the system is tailored at establishing an efficient and effective electronic voting system aimed at improving students' government democracy, and reducing electoral irregularities and malpractices in students' union elections.

Kamya (2017) noted that with the proposed system, results misrepresentation will be cut down since votes are automatically tallied by the system, increased voter turn up will be achieved since there will be no need for voters to travel distances in order to participate, and data processing will become more accurate since human errors will be minimized in final result calculations.

Zakaria and Safawee (2025) concluded that online voting systems have markedly improved accessibility, allowing participants to vote from any location and significantly reducing physical barriers associated with traditional polling stations. Preliminary data suggests an increase in voter participation compared to previous election cycles using paper ballots and electronic machines. The system enhances security, efficiency, and cost-effectiveness by streamlining the voting process, reducing time and resources required for election administration, and eliminating paper-based procedures.

AboSamra et al. (2017) emphasized that electronic voting aims to decrease the time needed for vote casting and vote counting, to reduce the cost of the election process, and to improve the accuracy of the results. A good electronic voting system would be much more exact and precise than the current one, with far fewer errors on paper than in electronic format.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter outlines the methods and procedures used to conduct the research. It encompasses system development that involves research design, area of study, population and sampling methods, data collection methods and analysis, design, implementation, testing and validation, and ethical considerations.

3.2 Research design

Given the nature of the data that was to be collected, which included both numerical figures and descriptive responses, the study adopted both quantitative and qualitative approaches to ensure complete data collection and system validation. The qualitative method involved in-depth interviews to gather detailed insights into user needs and system requirements from students, electoral commission members, and administrators at Rock High School. This approach was chosen to capture complicated perspectives on natural preferences and challenges in manual voting. The quantitative method was used to validate the system through structured testing, measuring user satisfaction, system performance, and adherence to requirements.

3.3 Area of study

The research was conducted at Rock High School, located in Tororo District, Eastern Uganda. The school was selected because it currently conducts student leadership elections (prefects, student council, club representatives) using traditional paper ballots and manual counting, the process is leads to delayed results, counting errors, ballot mismanagement and lack of transparency.

3.4 Population and sampling method

Population total

The target population for this study comprised of students, teachers (electoral commission members), and the school administrators at Rock High School. Based on school records, the total population (N) is approximately 20 students, three teachers (acting as the electoral commission), and one school administrator.

Participants

Male

Female

<i>Administrator</i>	1	-
<i>Teachers(Electoral)</i>	1	2
<i>Students</i>	10	10
<i>Total</i>	12	12

Table 1: participants

3.5 Data collection methods and analysis

Data collection involved in-depth interviews to identify requirements and gaps in the existing voting system. A semi-structured interview was conducted with the electoral commission members and administrators to explore challenges faced with the system. 12 semi-structured interview questions were developed to guide data collection. This number was chosen to ensure complete requirement gathering while maintaining data quality.

For data analysis, qualitative data from interviews was examined and organized to identify challenges faced by students, electoral commission members, and administrators when managing elections. Quantitative data from system testing was analyzed using descriptive statistics to evaluate user satisfaction. Based on these analyses, the final system requirements were validated.

3.6 System development

The system was developed using Structured Systems Analysis and Design Methodology (SSADM) because it provides a clear, step-by-step approach to system development. Specifically, Rapid Application Development (RAD) was used because of the limited time. The RAD approach followed four key phases: requirements determination, design, implementation, and testing. Eventually, a working prototype was developed which was tested and validated.

3.7 Design

The system design phase involved creation of a blueprint of the web-based Clearance system. The design process steps were as follows;

The development follows the **Rapid Application Development (RAD)** approach within the Structured System Analysis Design Method (SSADM) framework. RAD is an agile methodology that prioritizes iterative prototyping and user feedback over rigid planning, aimed at shortening the transition from planning to implementation.

The main aim of using RAD in this research is to shorten the time in a traditional system development life cycle between planning and implementing an online transaction processing system.

There are four stages under RAD;

1. **Requirement determination.** Analysts engage with students and teachers to identify pain points, such as ballot loss, long queues, and lack of real-time results.
2. **Design.** At this stage, this iterative phase involves creating system mockups. Users provide input on the interface for voting and viewing candidate dashboards.
3. **Implementation.** This is where the system is built and coded based on the design specifications.
4. **Testing.** The final stage where the system is checked for user satisfaction, ensuring it effectively generates accurate election results.

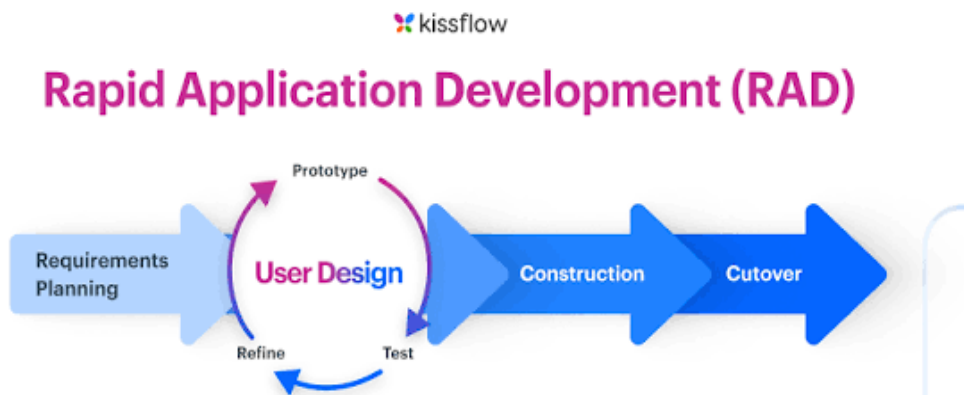


Figure 1: Rapid Application Development Process

System Architecture

This defined the overall structure of the system and outlined how components interact. The architecture adopted a client-server model, where the frontend provided user interfaces for students and electoral commission members, and the backend handled data processing and storage, which ensured efficient data flow.

Context Diagram

The context diagram illustrated the system's interactions with external entities, such as students and staff (electoral commission and administrators). These provided a high-level view of the system's scope and boundaries.

Dataflow Diagram (DFD)

The DFD illustrated how information moves through the system. It broke down the system's main functions into smaller processes, showing how data is transformed from input into useful output for both students and staff (electoral commission and administrators).

UML Diagram (Use-Case Diagram)

A Use-Case Diagram visually summarized the interactions between the system's users (called "actors") and the key functions (called "use cases") the system provides. It helped ensure that the system is designed to meet the core needs of both students and staff (electoral commission and administrators). The diagram featured three primary actors namely students who uses the system to vote, electoral commission members who manage the election process, and the administrators who manages and monitors all system activities.

3.8 Implementation

The system was developed using modern web technologies to ensure reliability, security, and ease of use. Visual Studio Code was the primary code editor for writing and managing project files, while web browser (Microsoft Edge) developer tools were employed for real-time debugging and testing of the frontend interface during development. The implementation followed a structured approach with clear separation between the backend and frontend components.

For the backend development, the server-side of the system was built using PHP: The server-side scripting language used to handle business logic, process votes, and communicate with the MySQL database. The frontend included HTML & CSS: For structuring the voting forms and styling the user interface, JavaScript: To handle client-side validation and asynchronous updates (AJAX) for a smoother user experience.

3.9 Testing and validation

The system went through rigorous testing to ensure it is functional, user-friendly, and reliable. The testing process included the following stages:

- 1. Unit Testing:** Individual components were tested in isolation to verify they worked correctly on their own. This included testing the login functionality, voting module, and result generation module.
- 2. Functional Testing:** The system was evaluated against the initial requirements to ensure all key features worked as intended such as the process of voting, candidate registration, and result generation.
- 3. Integration Testing:** All system components were tested together to ensure they interact seamlessly. For example, the user interface was tested on how it communicates with the server and database to confirm that data flows smoothly.
- 4. User Acceptance Testing (UAT):** 20 students, 3 teachers (electoral commission members), and 1 administrator from the study sample used the system in a real-world setting at Rock High School. Their feedback on the system's ease of use, interface design, and the relevance of the advice was collected to identify any final improvements needed.
- 5. System Validation:** The final system was evaluated to confirm it meets the objectives of the study. The system was validated to ensure that it successfully allows students to register and vote, and provides useful tools for staff (electoral commission and administrators) monitoring. Success was measured through user satisfaction surveys and feedback from system participants.

3.10 Ethical consideration

The study adhered to the following ethical principles to ensure integrity and protect participants;

1. **Informed consent.** All participants were informed about the study's purpose, procedures, and written consent was obtained before interviews.
2. **Confidentiality.** Participant's data was stored securely in compliance with data protection regulations.
3. **Participation was voluntary.** Participants were free to withdraw at any time without consequences.
4. **Transparency.** Findings and system outcomes were shared with participants, promoting trust and accountability.
5. **Risk minimization.** The study prioritized doing no harm by ensuring the system was rigorously tested to prevent errors in the voting process.
6. **Respect for autonomy.** Participants' rights to make informed decisions about their dietary practices and system usage was respected.

CHAPTER FOUR: FIELD STUDY AND SYSTEM DESIGN

4.1 Introduction

This chapter presents the results from the field study conducted at Rock High School, Tororo. This chapter describes background information of the current system and new system requirements gathered during the study, including user requirements, functional requirements, and non-functional requirements. It also details the design of the proposed system, covering the system architecture, context diagram, data flow diagrams, entity relationship diagram, and use case diagram.

4.2 Background information of the current system

The current system at Rock High School for voting is completely manual. Students are required to physically move to a designated polling station to cast their votes on paper ballots. The following problems were identified during the field study:

- 1. Time Consuming and Costly.** The voting process was found to be time-consuming due to physical movement, long queues, and delays caused by slow manual counting. Students reported taking several hours or even the entire school day to complete the voting process.
- 2. Poor Record Management.** Since the system relied on paper-based ballots, voting documents were highly vulnerable to loss, misplacement, and physical damage. In cases where ballots were lost, students were unable to have their votes counted.
- 3. No Real-Time Monitoring.** Administrators and the electoral commission did not have a centralized system to monitor voting activities. This made it difficult to track voter turnout, identify delays, or monitor the integrity of the process.
- 4. Limited Security and Data Integrity.** The current manual system does not have security mechanisms to protect voter information or ensure one-student-one-vote. Unauthorized access to ballots was possible since they were stored physically.
- 5. Environmental Littering.** Physical campaigns resulted in the littering of school walls and environment with posters and fliers, creating an untidy campus appearance.
- 6. Election Violence and Chaos.** Student politics, campaigns, and voting could be tense, sometimes leading to conflicts and chaos during rallies and voting day.

4.3 System Study and Analysis

The study was carried out at Rock High School. The main purpose of the study was to find out the challenges faced during the voting process by students, as well as the difficulties encountered by staff (electoral commission and administrators) in monitoring the election and managing voter data. The study involved examining the existing manual system to identify its strengths and weaknesses. The information acquired from the study was gathered by employing a number of data collection methods, including semi-structured interviews and questionnaires administered to both students and staff (electoral commission and administrators). The data collected were analyzed to provide the basis for designing a new, web-based voting system.

4.3.1 Findings from interviews and questionnaires

Findings from the Student Questionnaire

A total of 20 students from Rock High School responded to the questionnaire. The survey aimed to understand current voting management practices, challenges faced, technology readiness, and desired features for the system. The findings are presented below.

A. Nature of the Current Clearance Process

The findings showed that all students relied on a manual voting process, which required them to physically visit a polling station in order to cast their vote. Students indicated that the process was often chaotic and not clearly structured, as some relied on instructions from peers rather than official guidance. This finding suggested that the current system lacked formal guidance mechanisms and standardized procedures. The dependence on informal communication indicated poor system design and inadequate user support, leading to increased likelihood of errors, repeated visits, and delays, thereby reducing the overall efficiency of the electoral process.

B. Delays and Time Consumption

A significant number of students reported that the voting process was slow and time-consuming. The delays were mainly attributed to long queues at polling stations, limited availability of staff, high number of students during peak periods, and the time-consuming nature of manual vote counting. Some students indicated that the process took several hours or even the entire school day

to complete. This finding demonstrated that the system operated sequentially and depended heavily on human availability, making it inefficient and unable to handle high demand. These issues negatively affected students' academic timelines.

C. Physical Movement and Inconvenience

Students reported that they were required to move physically to a polling station, often across different locations within the campus. This movement resulted in increased time wastage, physical fatigue, and inconvenience. This indicated that the system was not user-centered and did not consider convenience. The requirement for physical presence made the system rigid and inefficient. This discouraged timely participation and created unnecessary burdens on students.

D. Loss and Mismanagement of Ballots

Some students reported cases where their ballots were lost or misplaced during the process. Since the system relied entirely on paper-based documentation, there was no backup or recovery mechanism. This finding indicated poor data management practices and lack of reliability in the system resulting in duplication of effort, delays, and increased stress for students, thereby reducing trust in the system.

E. Technology Readiness of Students

The findings showed that a large proportion of students owned smartphones, had access to the internet, and were familiar with web-based systems. This demonstrated that the users had the necessary technological capability to interact with a digital system. The high level of technology readiness supported the feasibility of implementing a web-based voting system.

F. User Expectations and Desired Improvements

Students expressed a strong need for improvements in the voting process. The most commonly suggested features included online voting, real-time tracking of results, candidate information and manifestos, notifications on election status, and reduction in physical movement. These expectations directly reflected the challenges experienced in the current system and the suggested features provided a clear direction for system design and confirmed the demand for automation and digital transformation.

Findings from the interview with the Staff and Administrators.

A semi-structured interview was conducted with the Staff and Administrators at Rock High School to understand current practices and desired system features.

Challenges in Manual Record Management

Staff reported that voting records were maintained manually using files and registers. This made it difficult to store records efficiently, retrieve past records, and track voter turnout. This indicated that the system lacked an organized data management structure and relied on inefficient storage methods limiting the ability of the institution to maintain accurate records and support administrative functions.

Increased Workload During Election Periods

Staff indicated that the number of students participating in elections increased significantly during certain periods, leading to work overload, delays in processing, and reduced service quality. This showed that the system was not scalable and could not efficiently handle high demand hence reduced staff productivity and slowed down the entire electoral process.

Lack of Centralized Monitoring and Control

Administrators reported that there was no centralized system for monitoring election activities. They were unable to track overall progress, identify delays or irregularities, or generate reports. This indicated weak administrative control and lack of visibility into system operations. The absence of monitoring tools hindered effective decision-making and reduced accountability.

Communication Gaps

Staff noted that students frequently returned to inquire about election results and voting procedures due to lack of communication mechanisms. This demonstrated that the system lacked automated communication channels. This increased workload for staff and contributed to inefficiency.

Security Concerns

Staff expressed concerns about the security of the manual voting process. They noted that the system was vulnerable to voter impersonation, multiple voting, and manipulation of results. These concerns highlighted the need for a system with robust security features.

Staff Recommendations

Staff and administrators recommended the introduction of a centralized digital voting system, automated vote counting, online voter registration, candidate profiles and manifestos, dashboards for monitoring, and reporting tools. These recommendations aligned closely with the challenges identified and reflected a need for system modernization. The input from staff provided strong justification for the proposed web-based system.

Conclusion of Findings

The findings from both students and staff clearly indicated that the existing manual voting system was inefficient, time-consuming, lacked transparency, and suffered from poor record management, security vulnerabilities, and limited administrative control.

Furthermore, the study established that users were technologically ready and strongly supported the introduction of a digital solution.

These findings provided a solid foundation for defining system requirements and designing a web-based voting system that would improve efficiency, enhance transparency, and streamline the electoral process.

4.4 User Requirements

User requirements describe what the system must do from the perspective of the end-users. The user requirements were categorized into functional and non-functional requirements as described below;

4.4.1 Functional Requirements

1. **Online Voter Registration.** Students must be able to register to vote digitally using their student ID and other verifying details. The system should verify eligibility before allowing registration.
2. **Candidate Management.** Administrators and electoral commission members must be able to add, update, and delete candidates for various positions. Candidates should be able to create profiles with their manifestos and photographs.

3. **Secure User Authentication.** Students, electoral commission members, and administrators must log in with their own username and password. This keeps each person's information private and secure and ensures only eligible voters can participate.

4. **Online Voting.** Students must be able to cast their votes securely online. The system should ensure that each student can vote only once and that votes are recorded accurately.

5. **Automated Vote Counting and Result Generation.** The system must automatically count votes and generate results immediately after the voting period ends. Results should be displayed in a clear and understandable format.

6. **Real-Time Status Tracking.** Students should be able to log in to monitor their voting status and view election progress in real-time.

4.4.2 Non-Functional Requirements

1. **Usability.** The system must be designed to be simple and easy to use. Buttons and menus must be clear so users do not get confused. The interface should be intuitive for users with varying levels of computer literacy.

2. **Performance.** Pages and reports should open quickly within a few seconds. The system should be able to handle multiple users simultaneously without significant delays.

3. **Security.** User information and votes must be protected with passwords and secure login methods. Data encryption should be used to protect sensitive information. No unauthorized person should access user data without permission.

4. **Reliability.** The system should work well without crashing during the voting period. It should also check that information entered is correct before saving it. The system should have backup mechanisms to prevent data loss.

5. **Scalability.** The system must handle more students, candidates, and administrators being added later. It will not need to be rebuilt if the number of users grows.

6. **Accessibility.** The system should be accessible from various devices including smartphones, tablets, and computers. It should be optimized for mobile devices to ensure students can vote from anywhere.

7. **Auditability.** The system should maintain a complete audit trail of all activities, including who voted, when they voted, and any administrative actions taken.

4.5 Hardware/ software requirements

4.5.1 Hardware Requirements

1. A server or hosting machine with a minimum of 80GB hard disk space
2. A server or hosting machine with a minimum of 4GB RAM
3. End users only require a smartphone, tablet, or computer with internet access

4.5.2 Software Requirements

Server-Side Software:

1. Windows, Linux, or macOS operating system
2. PHP
3. HTML
4. MySQL database management system
5. CSS

End User Software:

6. A modern web browser such as Microsoft Edge or Google Chrome

4.6 System Design

Based on the gathered requirements, the system was designed following the development approach described earlier in chapter 3.

4.6.1 The system architecture

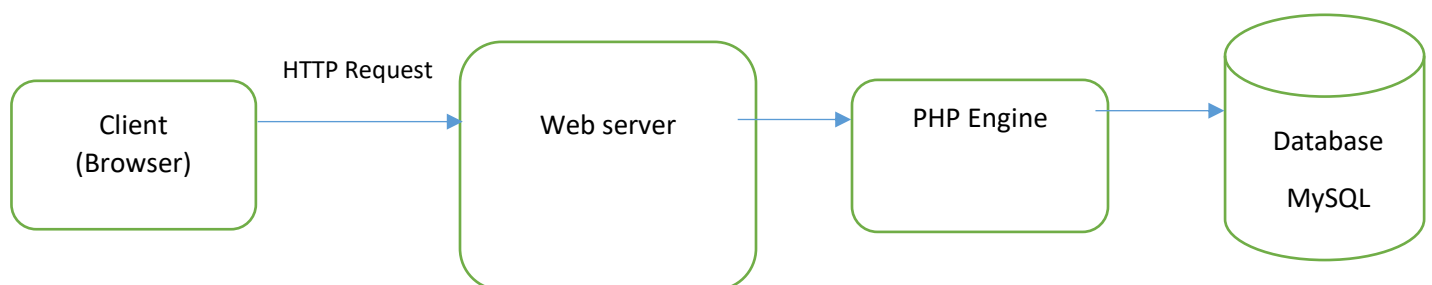


Figure 2: System architecture



Client Side (Frontend): The client side represents the presentation layer of the system, comprising the devices and web browsers through which end-users interact with the application.

1. **Student Client:** Accessed via smartphones or computers, this interface allows students to register, login, view candidate profiles, cast votes, and view results.
2. **Electoral Commission Client:** Accessed via smartphones or computers, this interface allows electoral commission members to login, manage candidates, monitor voting, and view results.
3. **Administrator Client:** Accessed via smartphones, computers or tablets, this dashboard enables administrators to view a list of registered users, access individual user logs, monitor system activities, and generate reports.

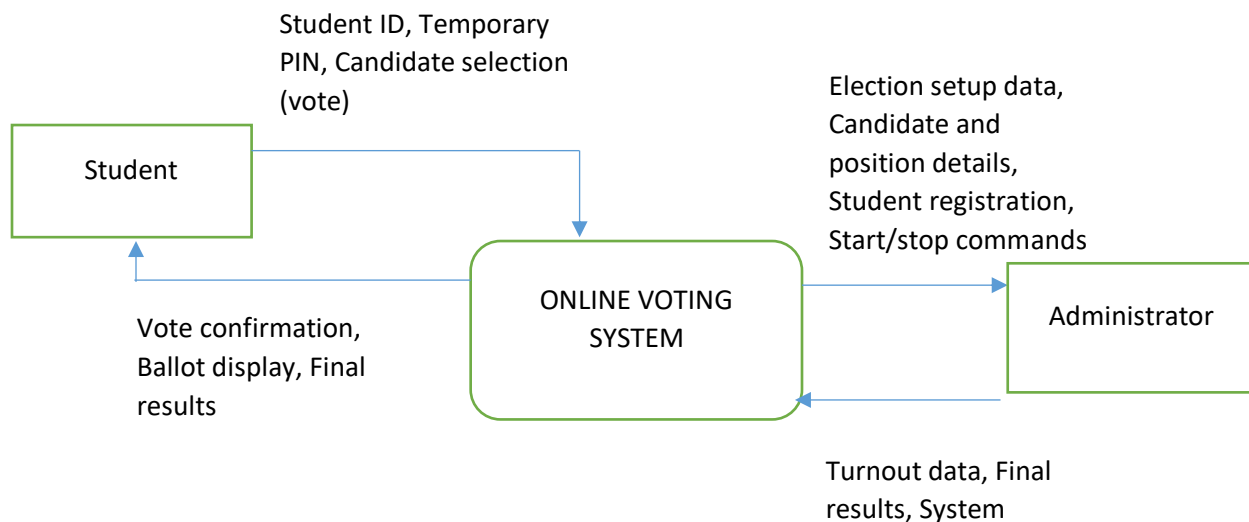
The client communicates with the server by sending HTTP requests (e.g., POST, GET) and receiving responses in JSON format.

Server Side (Backend): The server side hosts the core application logic, data storage, and integrations with external services. It is responsible for processing client requests, enforcing business rules, securing data, and returning appropriate responses.

1. **Web Server:** This acts as the entry point for all client requests. It handles incoming HTTP/HTTPS traffic, serves static files, and routes API requests.
2. **Application Server:** This forms the core component of server-side architecture and is responsible for handling all the business logic. The application server is organized into modules that correspond to system functionalities which include student module, electoral commission module, administration module, voting module, and result generation module.
3. **Database Server:** The database server stores, manages, and retrieves all persistent data within the system. A Relational Database Management System (RDBMS) which is MySQL is used for development. The database contains the following key entities: User profiles, student details, candidate profiles, position details, votes, and election records.

4.6.2 Context Diagram (Level 0 DFD)

3.8.2 Context Diagram.



Inputs and Outputs for Context Diagram

From Students to System (Inputs):

1. Students provide registration details during account creation (username, password, student ID, name, class)
2. Students enter login credentials to access the system
3. Students submit their votes for various positions
4. Students view candidate profiles and manifestos

From System to Students (Outputs):

1. The system provides registration confirmation
2. The system provides real-time voting status updates
3. Students receive notifications regarding election events

4. Upon completion of voting, the system displays election results

From Administrator to System (Inputs):

1. Administrators log in using secure credentials
2. They perform user management (register, update, delete users)
3. They configure system settings such as positions, election dates, and candidate registration periods
4. They add, update, and delete candidates

From System to Administrator (Outputs):

1. The system generates voting reports and statistics
2. Administrators access a dashboard for monitoring system activities
3. They can view user activity logs and overall system performance
4. They can view voter turnout and election results

From Electoral Commission to System (Inputs):

1. Electoral commission members enter login credentials
2. They approve or reject candidate registrations
3. They monitor voting activities and view results
4. They generate reports on the election process

From System to Electoral Commission (Outputs):

1. The system displays pending candidate registrations
2. Officers can view student details and voting statistics
3. Notifications are received when new candidates register or when voting milestones are reached

4.6.3 Data flow diagram (DFD)

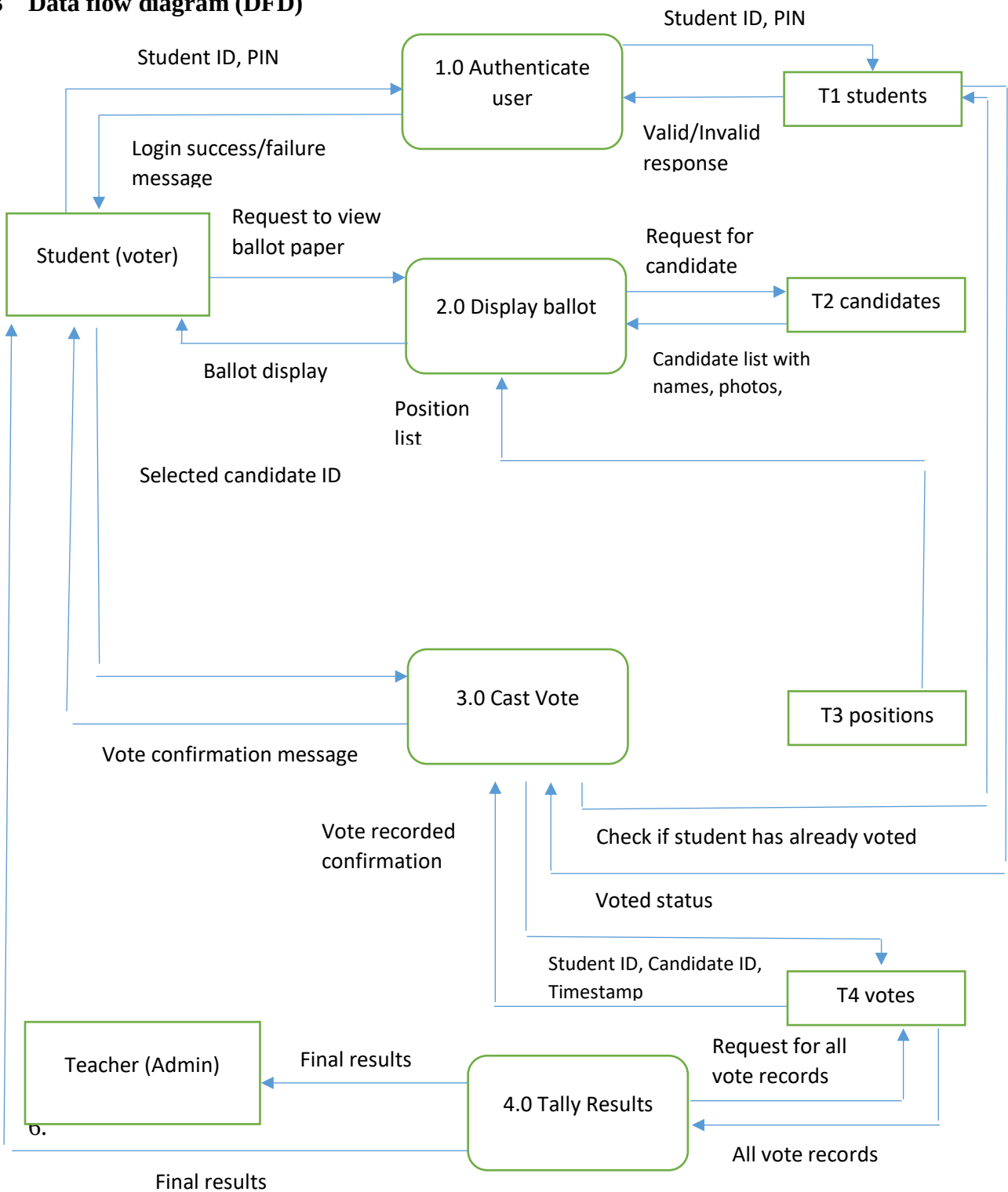


Figure 4: Data Flow diagram

The components of the DFD Level 1

1. Processes

These are the main functions of the system. They include:

Manage Account. This process handles everything related to user accounts including registration, login, and profile updates for students, electoral commission members, and administrators. It ensures secure authentication and stores user details in the system.

Manage Candidates. This process allows administrators and electoral commission members to add, update, and delete candidates. It also manages candidate profiles and manifestos.

Manage Voting. This process handles the voting process including displaying candidates, recording votes, and ensuring one-vote-per-student. It stores votes in the database and updates vote counts in real-time.

Generate Results. This process automatically counts votes and generates results for each position. It displays results in a clear format and generates reports for administrators.

Monitor System. This process allows administrators to view users' information, monitor system activities, and generate reports. When an administrator requests to see a user list, user profiles, or system logs, this process retrieves that data from the database and displays it on the admin's dashboard.

2. Data Stores

These are where all the information is kept. The data stores include:

User Profiles. This is where all account information is stored. It contains student, electoral commission member, and administrator details like names, contacts, passwords, and roles. Process 1.0 saves new profiles here and reads from it during login.

Candidate Profiles. This is where all candidate information is stored. It contains candidate details, positions they are contesting for, manifestos, and photographs. Process 2.0 writes new entries here and Process 3.0 reads from it when students view candidates.

Votes. This is where all votes are stored. It contains records of who voted, which position they voted for, and which candidate they selected. Process 3.0 writes new entries here and Process 4.0 reads from it when generating results.

Election Records. This is where all election results and reports are stored. Process 4.0 writes results here and Process 5.0 reads from it when administrators generate reports.

3. External Entities

These are people who use the system. They include:

Student. The person who registers, views candidate profiles, and casts votes. They interact with Process 1.0 (account management), Process 2.0 (view candidates), and Process 3.0 (voting). They receive outputs from Process 4.0 (results).

Electoral Commission. The persons who manage candidates, monitor voting, and view results. They interact with Process 1.0 (account), Process 2.0 (manage candidates), Process 3.0 (monitor voting), and Process 4.0 (view results).

Administrator. The person who monitors and manages the system, students, and electoral commission members. They interact with Process 1.0 (account), Process 2.0 (manage candidates), Process 3.0 (monitor voting), Process 4.0 (generate reports), and Process 5.0 (monitor system), and receive users' data and logs from the system.

4. Data Flows

This shows how information moves in the system:

- Register/Login, update profile: Account information sent from user to Process 1.0
- Store/Retrieve: Data being saved to or read from the User Profiles store
- Display: User information shown back to the user after login or update
- Candidate Registration: Candidate details sent to Process 2.0
- Candidate Profile: Candidate information displayed to students in Process 3.0
- Vote Submission: Vote data sent from student to Process 3.0
- Vote Recording: Vote data saved to the Votes store
- Result Generation: Votes retrieved from Votes store and processed by Process 4.0

- Report Generation: Data retrieved from Election Records and displayed to administrators

4.6.4 The Use Case Diagram

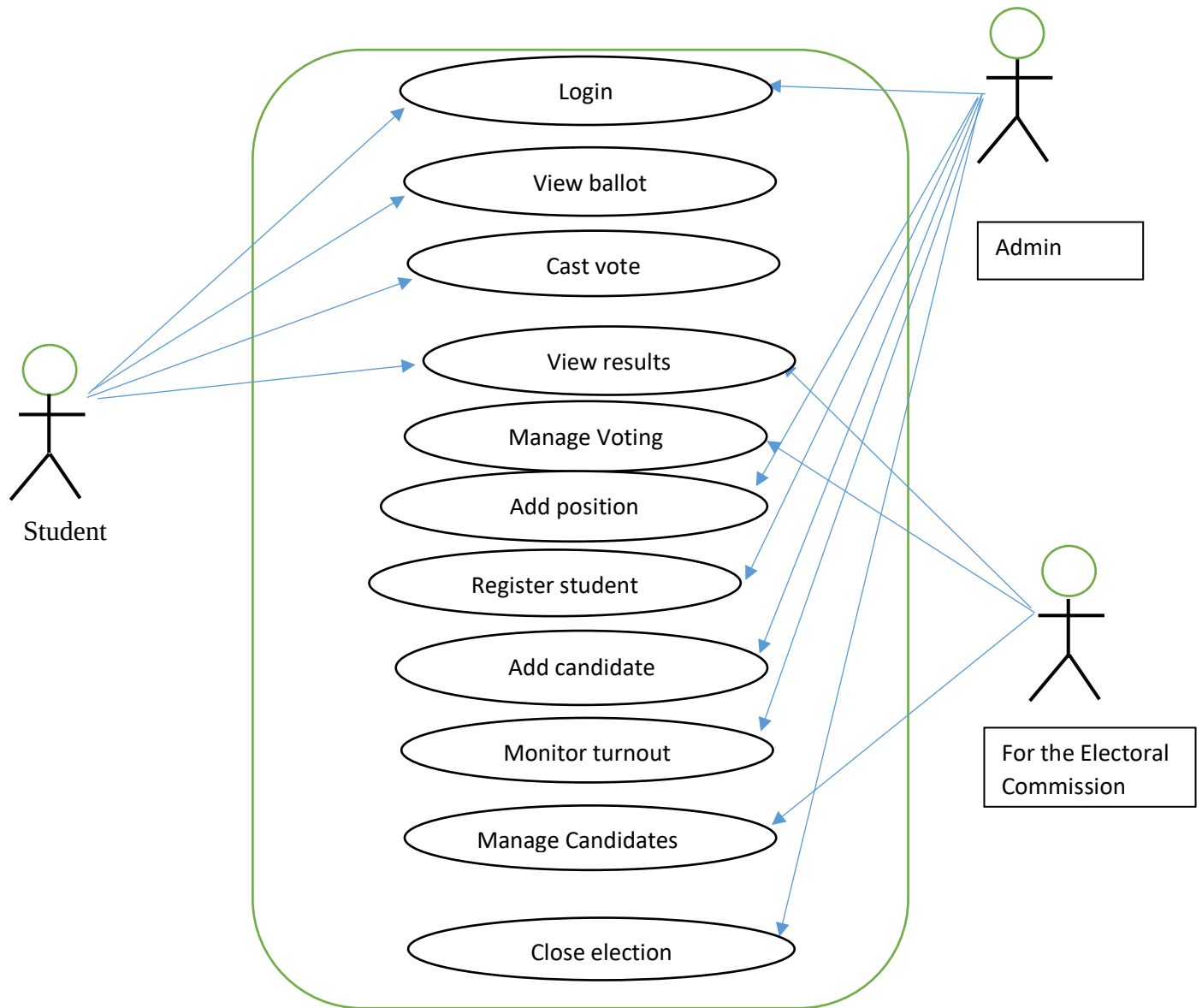


Figure 5: Use case diagram

Actors

1. Student: This is the person who registers to vote and casts votes. They use the system to register, view candidate profiles, cast votes, and view election results.

2. Electoral Commission: This is the staff responsible for managing the electoral process at Rock High School. They use the system to manage candidates, monitor voting activities, and view results.

3. Administrator: This is the person responsible for overall system managing of all users' activities in the system. They use the system to manage user accounts, monitor system activities, and generate reports.

Use Cases

For the Admin:

1. Manage Account. The admin can create an account for a user, update users' details like their name, contact, and role. This keeps their information current and accurate.

2. Manage System Settings. The admin can configure system settings such as election dates, registration periods, and voting periods.

3. Generate Reports. The admin can generate reports on voter turnout, election results, and system activities for decision-making.

4. Monitor System Activities. The admin can view user activity logs and overall system performance.

For the Electoral Commission:

5. Manage Candidates. The electoral commission can add, update, and delete candidates for various positions. They can also approve or reject candidate registrations.

6. Monitor Voting. The electoral commission can monitor voting activities, view voter turnout, and ensure the integrity of the process.

7. View Results. The electoral commission can view election results as they are generated.

For the Student:

8. Register to Vote. The student can create an account and register to vote using their student ID and other details.

9. View Candidate Profiles. The student can view profiles of candidates including their manifestos and photographs.

10. Cast Vote. The student can vote for their preferred candidates for various positions.

11. View Results. After the voting period ends, the student can view election results.

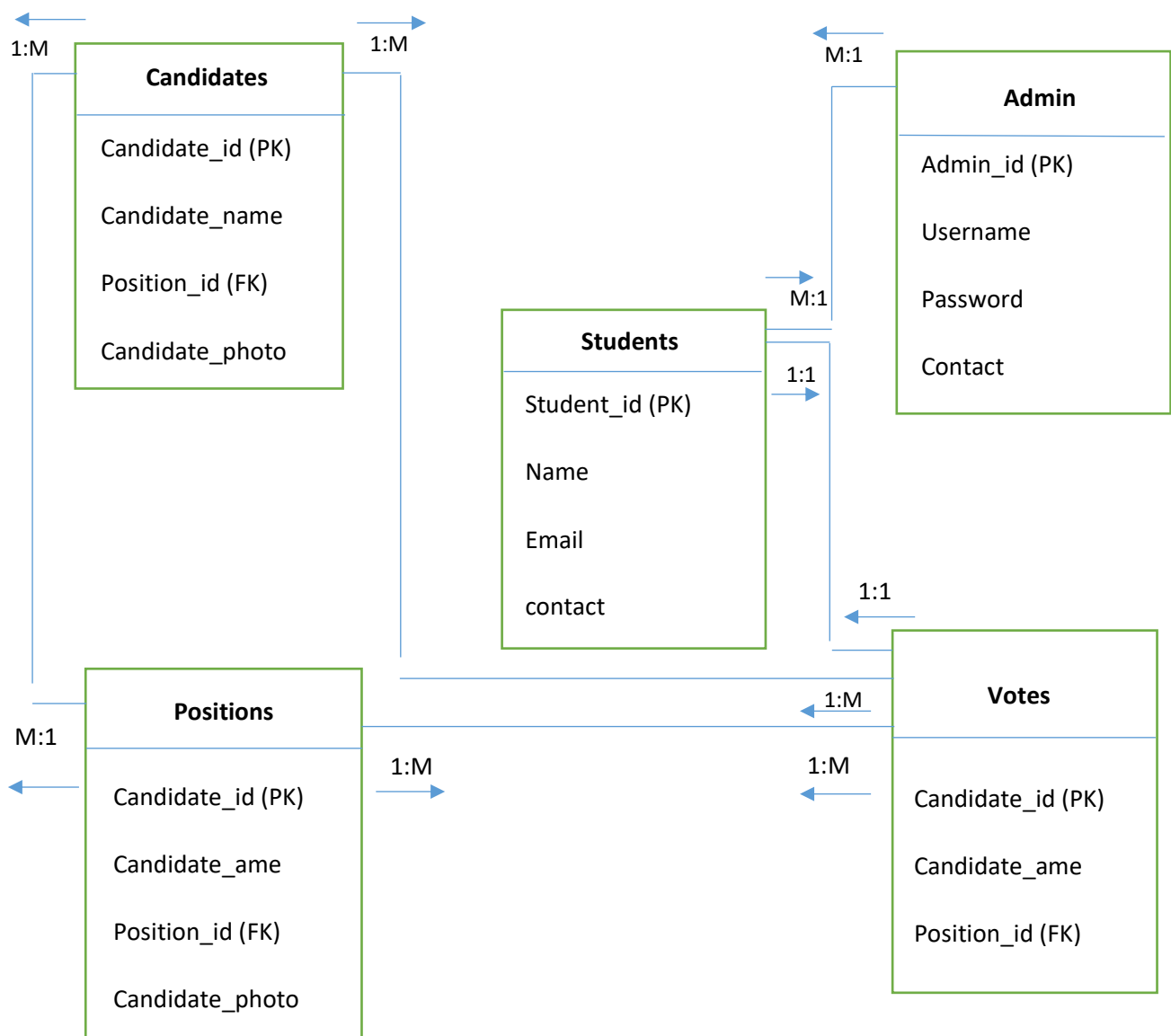


Figure 6: Entity Relationship Diagram (ERD)

Explanation of each table and its relationships in the ERD:

Tables in the ERD

1. Student Table: This table holds all the important information about each student. It includes details like the student's ID number, full name, registration number, date of birth, contact information, and email.

Field	Data type	Description
student_id (PK)	INT (pk)	Unique student_ID
student's name	Varchar (100)	Full name of student
Reg_no	Varchar (50)	Registration number
student_dob	date	Date of birth
student_contact	Varchar (100)	Phone contact
student_email	Varchar (100)	Student email

Table 2: Student Table

2. Position Table: This table stores information about positions that students can contest for

Field	Data type	Description
Position_id ((PK)	INT (pk)	Unique officer_ID
position_name	INT (fk)	Name of position
Description	Varchar (100)	Position description
election_date	Date	Date of election

Table 3: Student Table

3. Candidate Table:

Field	Data type	Description
candidate_id (PK)	INT (pk)	Unique request_ID
student_id (FK)	INT (fk)	Student id of candidates
position_id	INT (fk)	Positions being contested
Manifesto	Varchar (1000)	Candidate's manifesto

Table 4: Candidate Table

4. Vote Table:

Field	Data type	Description
vote_id (PK)	INT (pk)	Unique clearance record_ID
student_id (FK)	INT (fk)	Linked clearance request
condidate_id (FK)	INT (fk)	Department reviewing request
position_id	INT (fk)	Reviewing officer
Time stamp	date time	Time of voting

Table 5: Vote Table

5. Election Table:

Field	Data type	Description
Election_id (PK)	INT (pk)	Unique department_ID
position_name	INT	Position for this election
Start_date	Date time	Election start date/time
end_date	Date time	Election end date/time
status	Varchar (1000)	Election status (pending, active, complete)
total_votes	INT	Total votes cast for this position
Winner_id (fk)	INT	Candidate ID of winner

Table 6: Election Table

Relationships in the ERD

1. **Student to User (1:1).** Each student has one user account, and each user account belongs to one student.
2. **Student to Vote (1:M).** One student can cast multiple votes for different positions. Each vote belongs to one student.
3. **Student to Candidate (1:1).** A student can be a candidate for one position. Each candidate is linked to one student.
4. **Position to Candidate (1:M).** One position can have multiple candidates contesting. Each candidate contests for one position.
5. **Position to Vote (1:M).** One position can receive votes from multiple students. Each vote is cast for one position.
6. **Candidate to Vote (1:M).** One candidate can receive votes from multiple students. Each vote is cast for one candidate.
7. **Position to Election (1:1).** Each position has one election record. Each election record is for one position.
8. **Candidate to Election (1:1).** Each candidate's results are recorded in one election record. Each election record is for one candidate.

CHAPTER FIVE: IMPLEMENTATION AND TESTING

5.0 Introduction

This chapter focuses on transforming the functional and non-functional requirements established in previous chapters into a working system. It presents the implementation of the design outlined in Chapter Four, including interface designs, database structures, and system testing procedures for the Web-Based Voting System at Rock High School.

5.1 Interface Design

The goal of user interface design is to make the user's interaction with the system as simple and efficient as possible in terms of accomplishing user goals. It focuses on the appearance and style of how the system appears to the end users. Below are the key interfaces for the system:

5.1.1 Landing Page

This page serves as an entry point of the system. It provides general information about the system and allows users choose whether to log in as a student, electoral commission member, or administrator. The page provides a brief overview of the system's purpose and features.

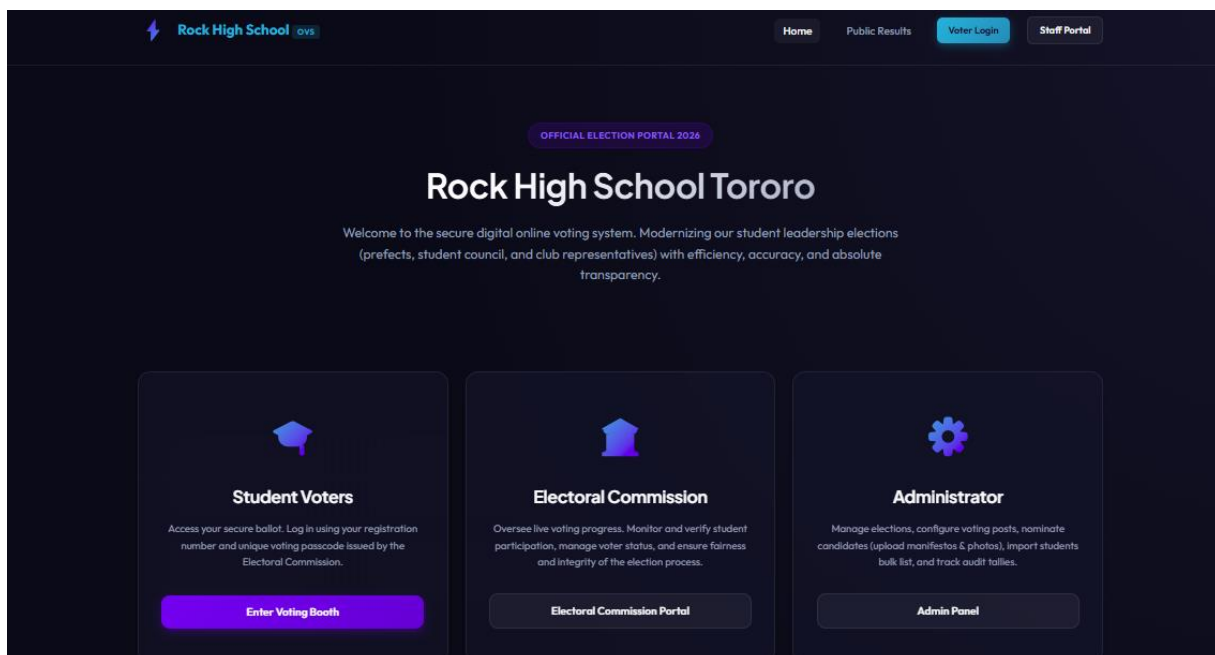


Figure 7: Landing page

5.1.2 Login Pages

The Login interface allows pre-registered users (students, electoral commission members, and administrators) to access the system using secure login credentials which directs to the user dashboard using their username and password.

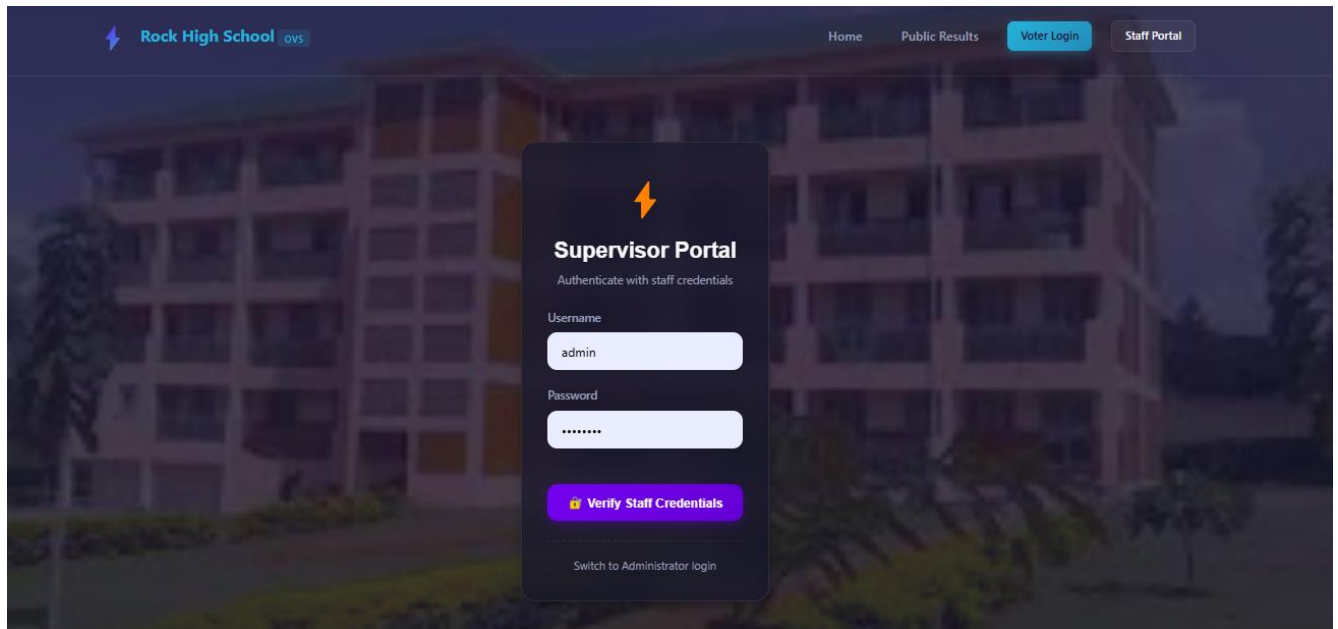


Figure 8: Login Page

5.1.3 Admin Dashboards

The Administrator Dashboard provides full system control and displays key metrics including total registered users, total voters, total candidates, voter turnout percentage, election status, recent activities, and user statistics.

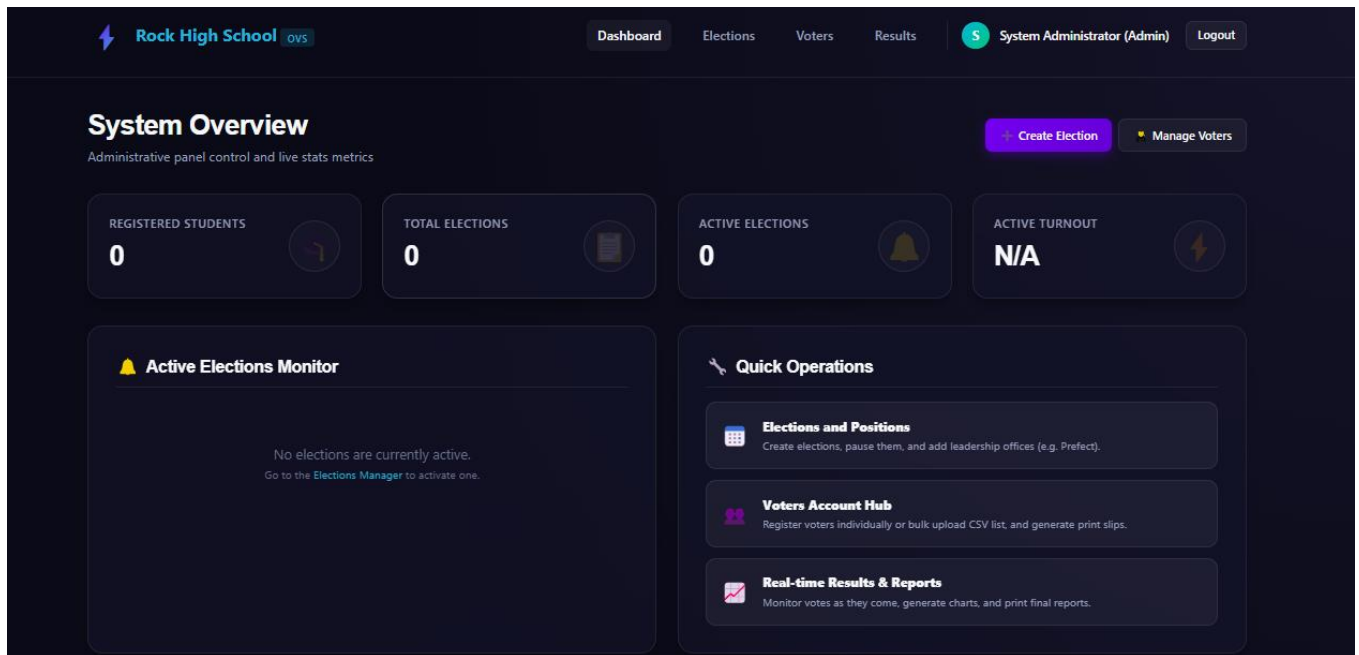


Figure 9: Administrator Dashboard

5.1.4 Real-time Results and Report

This Dashboard shows the results and election status, for example available elections, candidate information, voting status, and election results.

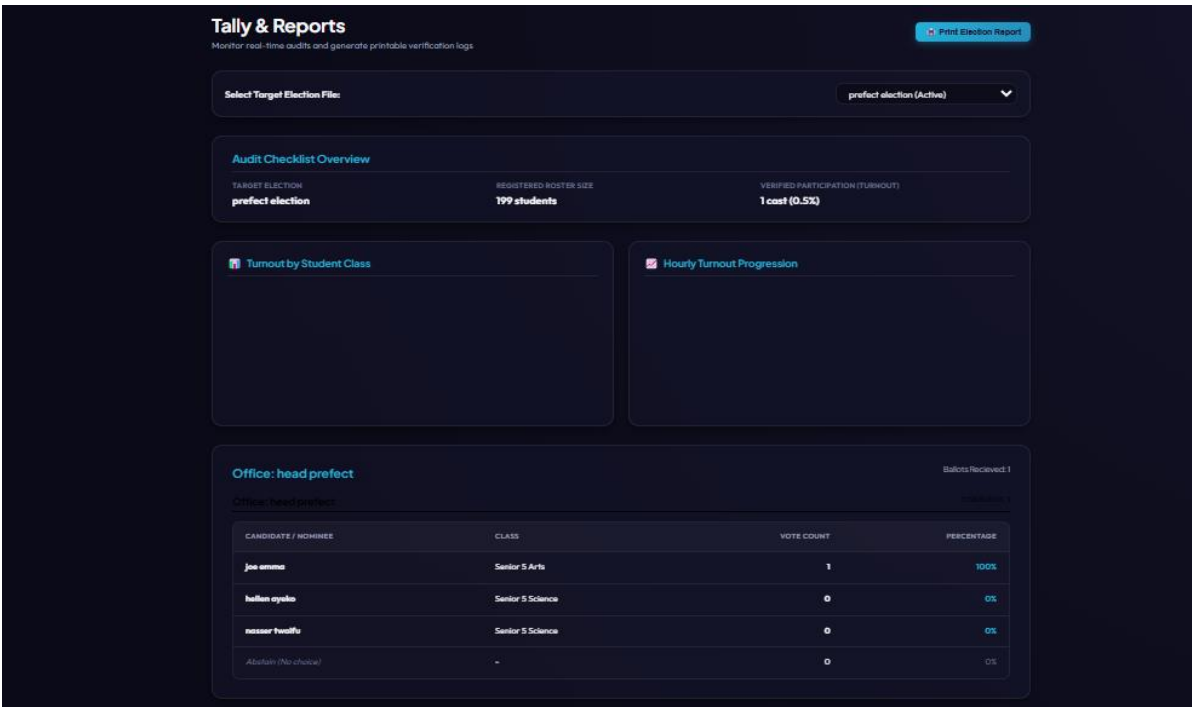


Figure 10: Student Dashboard

5.1.5 Voter Accounts

The All-users List Page displays all students eligible to use the system and vote. This module is primarily handled by the administrator who ensures that only authorized individuals can access the system.

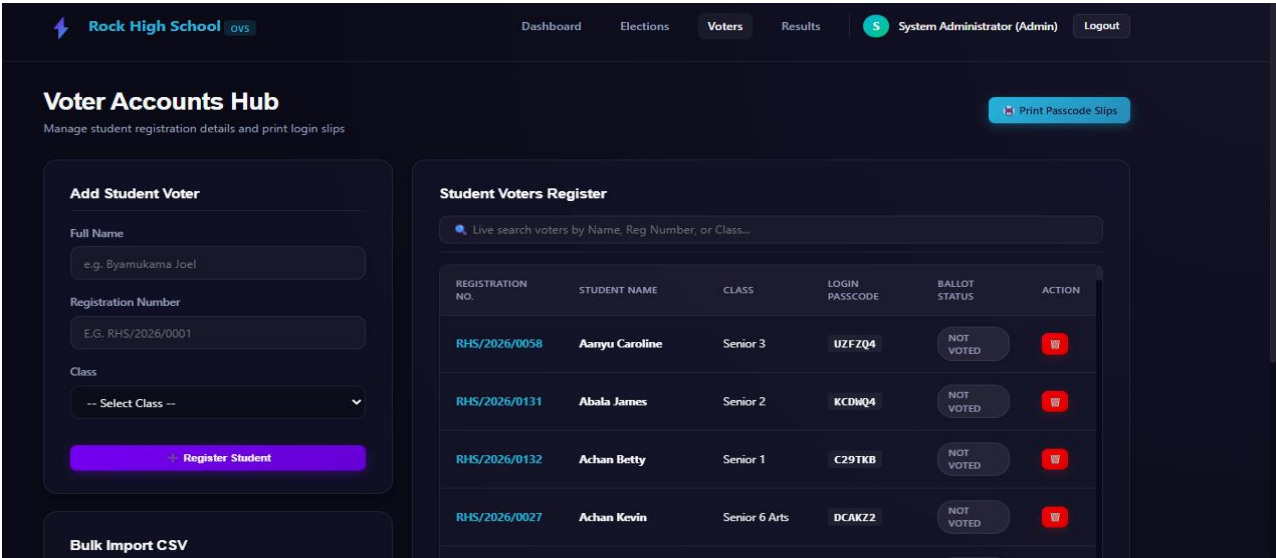


Figure 11: Voter Accounts

5.1.6 Voter Dashboard

Voting Page: The voting page is the main interface where students cast their votes. It displays candidates for each position with their photos and manifestos. Students select their preferred candidate and confirm their vote.

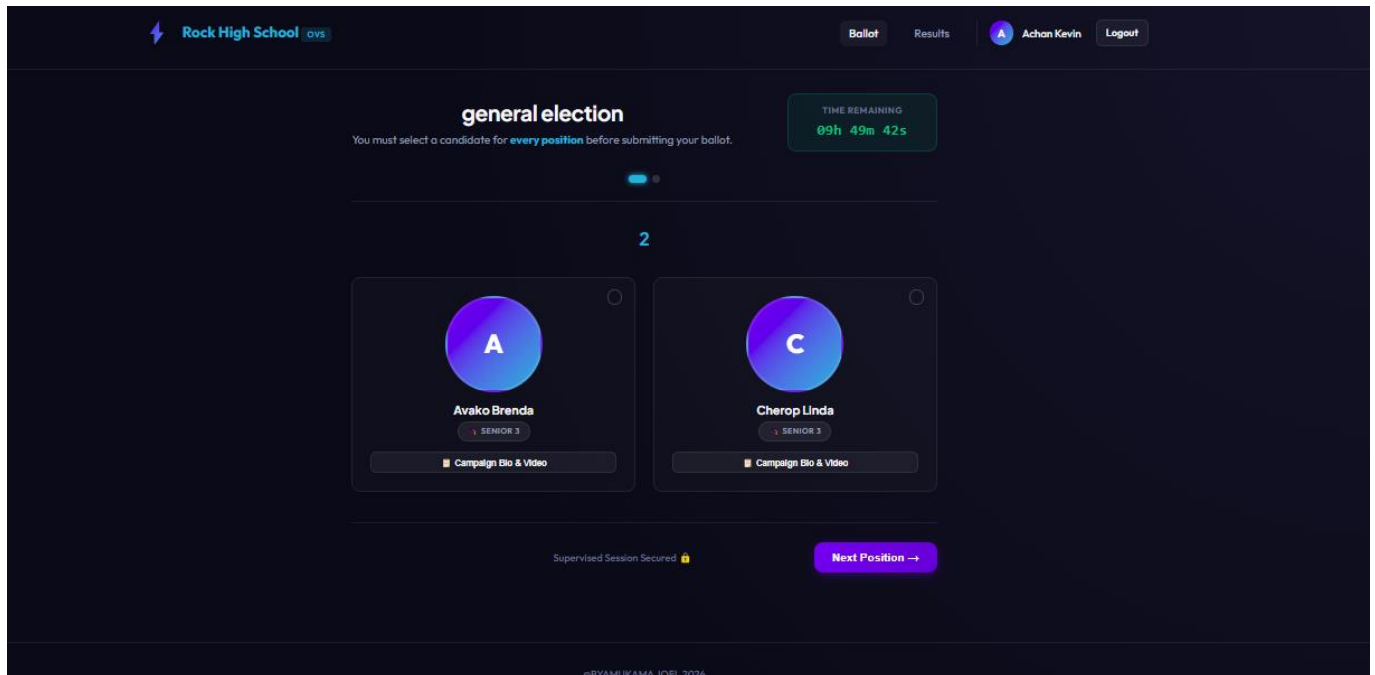


Figure 12: Voter Dashboard

5.2 Data Storage

The system's database stores all persistent data required for system operation, including user profiles, candidate information, votes, and election records. The following tables were implemented using MySQL for development.

5.2.1 User Table

The User table stores personal information for each user, including user ID as the primary key, full name, contact details, email address, user type, username, password hash, and account status. This table is used to uniquely identify each user and manage authentication.

5.2.2 Student Table

This table stores student-specific information including student ID as the primary key, registration number, date of birth, class, and other student details. This table is linked to the User table through the student_id foreign key.

5.2.3 Position Table

This table stores information about positions available for election including position ID as the primary key, position name, description, and election date.

5.2.4 Candidate Table

This table stores candidate information including candidate ID as the primary key, student ID as a foreign key, position ID as a foreign key, manifesto, photo path, and approval status.

5.2.5 Vote Table

This table stores all votes cast by students including vote ID as the primary key, student ID as a foreign key, candidate ID as a foreign key, position ID as a foreign key, and timestamp of voting.

5.2.6 Election Table

This table stores election records including election ID as the primary key, position ID as a foreign key, start date, end date, status, total votes, and winner ID.

5.3 System Testing

The entire system was tested using various methods to ensure accuracy and efficient operation before delivery to the final users.

5.3.1 Unit Testing

Unit testing verified individual components including the login functionality, registration module, voting module, result generation module, and dashboard modules. Each unit was tested to ensure it worked correctly in isolation.

5.3.2 Integration Testing

Integration testing ensured all modules worked together as a complete system, validating data flow between the frontend, backend, and database. This included testing the communication between the voting module and the database to ensure votes were properly recorded.

5.3.3 Functional Testing

Functional testing evaluated core features against the specified functional requirements including user registration, candidate management, voting, result generation, administrative dashboard displays, user monitoring, and data storage.

5.3.4 User Acceptance Testing

User acceptance testing was carried out at Rock High School using the system in a real-world setting.

5.3.5 System validation

After completion of system testing, the system was validated to confirm the developed system met the intended objectives and user requirements. Validation focused on assessing system functionality, ease of use, performance, reliability, and security.

The validation results showed that:

- The system accurately processes votes and generates correct results
- Unauthorized access is prevented through authentication and role-based access control
- Data is securely stored and retrieved from the database
- Each student can vote only once
- Results are displayed accurately and in real-time
- Users found the system easy to use and navigate
- The system handles multiple simultaneous users without performance issues

CHAPTER SIX: DISCUSSION, CONCLUSION, RECOMMENDATION AND FUTURE WORK

6.0 Introduction

This chapter discusses the findings from developing a Web-Based Voting System for Rock High School in relation to the set objectives and methodology outlined in Chapter One. The study found that the voting process fully relied on manual methods, where students physically gather at polling stations to cast their votes. This system focuses on replacing this manual method with a digital platform that enables online voting, real-time result tracking, and efficient election management.

The implementation of this system involved the administrators, electoral commission members, and students at Rock High School, with validation results discussed as shown in Chapter Five.

6.1 Discussion

The discussion of this chapter is based on the theme of objectives stated in the first chapter.

Objective (1): To review the literature and determine requirements for developing a Web-Based Clearance system

The requirements of the study were obtained from two main sources: library research and field research. Under library research, the study examined previous projects on similar topics, including online voting systems from Makungu et al. (2018), Mbamala (2022), Kanya (2017), AboSamra et al. (2017), and Zakaria and Safawee (2025).

The field research, conducted through interviews and questionnaires with the students, electoral commission members, and administrators, helped establish how the manual system operates and gathered respondents' views toward the proposed digital system. The field research generated key requirements, including the need for online voter registration, candidate profiles and manifestos, secure voting, real-time result tracking, and administrative reporting tools. Key functional requirements identified included online voter registration, secure authentication, candidate management, online voting, automated vote counting, real-time results, and administrative dashboards. Non-functional requirements included usability for users with varying digital literacy, performance within acceptable time frames, security through authentication and encryption, and scalability to accommodate more users over time.

Objective (2): To design a web-based clearance system based on the determined requirements

The system was designed depending on the requirements gathered, followed by the Rapid Application Development (RAD) approach from the Structured Systems Analysis and Design Methodology (SSADM). The design stage included the System Architecture (client-server model), Context Diagram, Data Flow Diagrams, Use Case Diagram, Entity Relationship Diagram (ERD), and Database Schema, which enabled the smooth flow of data throughout the system.

The System Architecture adopted a three-tier client-server model. The client side (frontend) was built using HTML, JavaScript and CSS, providing separate interfaces for students, electoral commission members, and administrators. The server side (backend) was built using PHP, handling business logic, processing votes, and communicating with the MySQL database. The database server used MySQL for development, storing student records, candidate profiles, vote records, and election data. **phpMyAdmin** was used for database administration

Objective (3): To implement a Web-Based clearance system

The implementation of the system design was carried out using the identified implementation tools which included: Visual Studio Code editor as the primary code editor, Microsoft Edge browsers for testing, MySQL for database management, PHP for handling business logic and processing votes, JavaScript and HTML for frontend development, CSS for styling, and Windows operating system. The implementation produced the interfaces shown in Chapter Five, which include: landing page and login pages, user dashboards, candidate management pages, voting pages, and results pages. The system was also optimized for mobile devices to ensure accessibility for students using smartphones.

Objective (4): To test and validate the Web-Based clearance system to ensure functionality and usability

The implementation of the system design was carried out using the identified implementation tools which included: Visual Studio Code editor as the primary code editor, Microsoft Edge browsers for testing, MySQL for database management, PHP for handling business logic and processing votes, JavaScript and HTML for frontend development, CSS for styling, and Windows operating system.

The implementation produced the interfaces shown in Chapter Five, which include: landing page and login pages, user dashboards, candidate management pages, voting pages, and results pages. The system was also optimized for mobile devices to ensure accessibility for students using smartphones.

Validation Results

After development and testing, the system was taken back to Rock High School and given out for testing to the electoral commission members and administrators and a sample of students in order to evaluate its performance, appearance, security, integrity, efficiency, effectiveness, and usability. The validation results showed positive feedback from students, electoral commission members, and the administration. Students found the voting interface easy to use and appreciated the ability to vote from anywhere. The electoral commission confirmed that the dashboard provided useful visibility into voter turnout and election progress. The administration confirmed that the system provided useful reporting tools and enhanced the transparency and integrity of the electoral process.

6.2 Conclusion

User feedback from Students indicates strong agreement that the Web-Based clearance system effectively meets their needs. The system directly tackles the key shortcomings of the previous manual clearance approach, which were outlined in the problem statement found in Chapter One. Departments can now clear students without physically being in the office while and administration are equipped to track students and department engagement and offer meaningful feedback. Given these capabilities, the system is well-suited for adoption at in Nagongera campus Busitema University.

User feedback from students indicates strong agreement that the Web-Based Voting System effectively meets their needs. The system directly tackles the key shortcomings of the previous manual voting approach, which were outlined in the problem statement found in Chapter One. Electoral commission members can now manage elections efficiently without the need for physical polling stations, while administration is equipped to track voter engagement and offer meaningful oversight. Given these capabilities, the system is well-suited for adoption at Rock High School and similar educational institutions.

The online voting system provides several key benefits:

Increased Accessibility: Students can vote from anywhere using their smartphones or computers

Improved Efficiency: Reduces or eliminates long queues and speeds up vote counting

Enhanced Security: Secure authentication and encrypted votes reduce the risk of fraud

Transparency and Accuracy: Real-time result tabulation provides clear and verifiable outcomes

Streamlined Administration: Reduces the administrative burden on teachers and the electoral commission

Environmental Friendliness: Eliminates paper usage, aligning with environmental sustainability goals

Enhanced Campaigning: Provides a digital platform for candidates to present their manifestos

6.3 Recommendations

I recommend that my Web-Based Voting System should be adopted by schools, especially those that are still using manual voting methods.

I recommend that my system be adopted by different academic institutions as a point of reference for the development of similar related systems, and for study purposes in courses related to system administration and web development.

I also recommend that the government of Uganda, through the Ministry of Education and Sports, adopt my system so that it can be deployed in various institutions across the country to support democratic processes and facilitate remote voting

Specific recommendations include:

1. Schools should adopt this online voting system for all student elections
2. The system should be piloted in smaller elections (e.g., club or class elections) to build confidence
3. Training programs for students and staff on how to use the system effectively

4. Regular maintenance and updates to ensure continued optimal performance
5. Integration with existing school management systems for seamless user experience

6.4 Limitations and Future Work

1. The system currently uses simple username/password authentication. Future work should incorporate biometric verification (e.g., fingerprint or face recognition) for enhanced security.
2. The system assumes students have internet access. In the future, an offline-capable Progressive Web Application (PWA) or integration with school Wi-Fi for all students could address this.
3. The system could be expanded to include features like live campaign Q&A forums, voter education materials, and more detailed analytics on voter turnout patterns.
4. The architecture could be scaled up in the future to accommodate elections for multiple schools within a district or country.
5. The system is not currently hosted, which limits its security, uptime, and accessibility. Therefore, the system should be hosted on a commercial web-hosting platform such as AWS or Google Cloud, to enhance its security and ensure optimal uptime.
6. System maintenance is necessary for continued optimal performance; therefore, regular maintenance should be performed to improve system performance based on user feedback.
7. Future work should incorporate SMS notifications in addition to in-app notifications to ensure students without smartphones can receive updates.
8. Future work should include a mobile application version of the system for enhanced user experience on mobile devices.

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