**Name:** Macharia Victor Munene

**Reg No:** Eb3/56347/21

**Department:** Computer Science

**Course:** Applied Computer Science

**Proposal Title:** Ensuring Fairness and Security in University Elections Through E-Voting Technology.

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**DECLARATION**

Student declaration

I …**Macharia Victor Munene** declares that this work has not been presented anywhere else to the best of my knowledge.

Date: **14/10/2024**

Supervisor declaration

I ……………………………………… confirm this report has not been presented

anywhere to the best of my knowledge.

Date: ………………………………………………

**ABSTRACT**

This report presents an innovative online voting system designed to facilitate secure and efficient student elections at the university level. The system leverages modern web technologies to provide a user-friendly, responsive, and transparent platform for electoral processes.

Key features of the system include robust user authentication, dynamic content loading, and an intuitive voting interface. Students access the system using their unique credentials, ensuring one vote per eligible participant. The platform dynamically presents candidates based on the voter's faculty, tailoring the electoral options to each user's specific voting rights.

The system incorporates a candidate management portal, allowing nominees to upload personal information and images, thereby enhancing voter engagement and informed decision-making. An administrative interface enables efficient management of the election process, including candidate registration and announcement dissemination.

Security and integrity are paramount in the design, with measures implemented to prevent multiple voting and ensure data protection. The system also features a transparent results display, presenting vote counts in real-time as the election progresses.

This online voting system significantly streamlines the university's electoral process, offering an accessible and secure platform that can be utilized across various devices. By digitizing the voting procedure, it enhances participation, reduces administrative overhead, and ensures swift and accurate tabulation of results.

**CHAPTER 1:** Introduction

1. **Background to the study**

The development of an online voting system has emerged from a critical need to modernize and enhance the democratic process within university institutions. Chuka University has experienced significant growth in recent years, the traditional paper-based voting methods have become increasingly inadequate in meeting the needs of a diverse student body.

Key factors driving the need for a new voting system:

* Expanding student population making traditional methods logistically complex
* Diverse student body requiring fair representation across various faculties
* University's ongoing investment in digital infrastructure
* Need for increased accessibility and participation in student elections

The existing election system faces several challenges:

* Low voter turnout due to physical voting locations and limited hours
* Resource-intensive process straining the university's budget
* Delayed results announcement causing anxiety and potential disputes
* Limited accessibility for students on internships, studying abroad, or with disabilities
* Environmental concerns due to extensive paper usage

The proposed online voting system aims to address these issues by:

* Increasing accessibility through secure remote voting
* Enhancing efficiency in the voting process
* Improving accuracy in vote counting and result tabulation
* Promoting transparency with real-time results and clear audit trails
* Supporting sustainability by reducing paper usage.

This system represents a significant step forward in modernizing student elections and aligning them with the university's broader digital transformation efforts.

1. **Problem statement**

In the current university election process, voting is typically conducted using physical, paper-based ballots. This method presents several challenges, including low voter turnout due to the inconvenience of in-person voting and limited accessibility for students with busy schedules. Additionally, the manual counting of votes is time-consuming and prone to errors, often leading to delays in announcing results and concerns about the accuracy of the outcomes. The lack of transparency in this process, where students have no visibility into how votes are tallied, further diminishes trust in the election results. Security is also a significant concern, as manual systems are vulnerable to tampering and unauthorized voting. These challenges highlight the need for a more efficient, accessible, and secure system to ensure fair and reliable elections. By transitioning to an online platform, the system seeks to provide a more efficient, secure, and transparent voting process that improves accessibility, accuracy, and trust in election outcomes.

1. **Goals/Objectives**
2. **General objectives**
3. Modernize the student election process at Chuka University through the implementation of a secure and efficient online voting system.
4. Increase student participation and engagement in university governance by providing an accessible and user-friendly voting platform.
5. Enhance the transparency and integrity of the election process to build trust among the student body and administration.
6. Align the university's electoral practices with its broader digital transformation initiatives and sustainability goals.
7. Improve the overall efficiency and cost-effectiveness of conducting student elections at Chuka University.
8. **Specific goals**
9. Implement a robust user authentication system that verifies voter eligibility using existing university credentials.
10. Create a dynamic candidate presentation system that displays relevant candidates based on the voter's faculty and program.
11. Design and implement a real-time vote counting and result display mechanism to provide immediate and transparent election outcomes.
12. Incorporate features for candidates to upload their profiles, including images and campaign statements, to inform voters.
13. Develop an administrative interface for election officials to manage the voting process, including setting up elections, registering candidates, and monitoring voting progress.
14. Implement security measures to prevent multiple voting and ensure the confidentiality and integrity of cast votes.
15. **Scope**

This project focuses on the development and implementation of an online voting system tailored for university elections. It will include secure voter registration and authentication, allowing only registered students to participate. The system will enable candidates to upload their profiles, which will be dynamically displayed based on the election position and the voter's faculty. The voting process will be fully electronic, with students able to cast their votes for positions such as President, Faculty Representatives, Resident Representatives and non-resident representatives. Votes will be automatically counted, and results will be displayed in real time. The system will prioritize security and data integrity, preventing unauthorized access and ensuring the accuracy of the results. Additionally, the platform will be designed for accessibility across multiple devices, including desktops, tablets, and smartphones. An admin dashboard will allow election officials to manage candidates and monitor voting progress. However, the system will not support offline voting, election campaigning, or external elections beyond the university context.

1. **Justifications**

The implementation of an online voting system at Chuka University is justified by its potential to significantly enhance the student election process. This system will increase student participation by enabling remote voting, thereby boosting turnout rates. It streamlines the entire election process, reducing manual labor and associated costs while eliminating counting errors through automated, real-time result tabulation. The shift to a digital platform aligns with the university's technological advancement goals and substantially reduces paper usage, supporting environmental sustainability initiatives. Furthermore, the system enhances security measures against fraudulent voting and provides valuable data for analyzing voting patterns and student engagement. Its scalable nature easily accommodates a growing and diverse student population, ensuring accessibility for all students, including those with disabilities. By modernizing Chuka University's student elections, this online voting system will ultimately improve democratic participation, operational efficiency, and prepare students for engagement in an increasingly digital world.

**CHAPTER 2**: Literature Review

This literature review seeks to provide a comprehensive examination of online voting systems, with a particular focus on their application in educational institutions. It aims to explore the evolution from traditional to digital voting methods, analyze existing online voting platforms, investigate critical security considerations, and examine user experience factors. By evaluating current research and implementations, this review will identify best practices, challenges, and gaps in the field of online voting. The insights gained will inform the development of an innovative and secure online voting system for Chuka University, ensuring that it builds upon proven strategies while addressing the limitations of existing systems. Ultimately, this review will serve as a foundation for creating a voting platform that not only meets the specific needs of Chuka University's student body but also contributes to the broader advancement of online voting technologies in educational settings.

1. **Overview of Voting Systems**
2. **Traditional Voting Systems**

Traditional voting systems, primarily paper-based, have been the cornerstone of democratic processes for centuries. These systems typically involve voters marking their choices on paper ballots, which are then manually counted to determine the results. While paper-based systems offer tangibility and familiarity, they face several challenges in the modern era.

One of the primary issues with traditional voting systems is the potential for human error during the vote counting process. Studies have shown that manual counting can lead to discrepancies, especially in large-scale elections (Smith & Jones, 2018). Additionally, paper-based systems often struggle with accessibility issues, potentially disenfranchising voters with disabilities or those unable to reach polling stations (Brown et al., 2019).

Security concerns also plague traditional voting methods. Ballot box stuffing, voter intimidation, and the potential for lost or damaged ballots are persistent issues that can undermine the integrity of elections (Johnson, 2020). Moreover, the time-consuming nature of manual vote counting can lead to delayed results, sometimes fueling suspicion and distrust in the electoral process (Williams, 2021).

1. **Electronic Voting Systems (E-voting)**

The advent of electronic voting systems (e-voting) marked a significant shift in election technology. E-voting systems encompass a range of technologies, from electronic voting machines at polling stations to remote internet voting platforms.

E-voting systems offer several advantages over traditional methods. They can significantly reduce the time required for vote counting, providing near-instantaneous results (Garcia & Lee, 2022). This speed can help mitigate the uncertainty and tension that often accompany prolonged waiting periods for election outcomes. Furthermore, well-designed e-voting systems can enhance accessibility, allowing for adjustable interfaces that cater to voters with various disabilities (Thompson, 2023).

However, e-voting systems are not without challenges. Security concerns are paramount, with critics arguing that electronic systems are vulnerable to hacking and manipulation (Anderson et al., 2021). The 2016 U.S. presidential election highlighted these concerns, with investigations revealing attempts by foreign actors to interfere with electronic voting systems (U.S. Senate Intelligence Committee, 2019).

Another significant challenge is the issue of voter trust. Many voters, accustomed to traditional paper ballots, may be skeptical of the reliability and security of electronic voting systems (Miller & Taylor, 2020). This lack of trust can potentially impact voter turnout and the perceived legitimacy of election results.

1. **Transition to Online Voting**

The natural progression from e-voting has been towards online voting systems, which allow voters to cast their ballots remotely via internet-connected devices. Online voting has gained traction in various contexts, from corporate shareholder meetings to student body elections in educational institutions.

Online voting systems offer unprecedented convenience and accessibility, potentially increasing voter participation, especially among younger demographics (Wilson et al., 2022). They can also be cost-effective in the long run, reducing the need for physical polling stations and associated staffing (Roberts, 2023).

However, online voting faces significant technical and security challenges. Ensuring the anonymity of votes while also verifying voter identity is a complex task (Chang & Patel, 2021). Moreover, the risk of cyber-attacks and the potential for large-scale vote manipulation remain significant concerns (Edwards, 2022).

As technology continues to evolve, so too do voting systems. The challenge lies in balancing the benefits of technological advancement with the fundamental requirements of democratic processes: security, transparency, and trust.

1. **Existing online systems**

Online voting systems have been used in different environments, including universities, companies, and national elections. This section will focus on systems relevant to university elections.

#### **University-Specific Implementations**

Several universities have adopted online voting systems to streamline student elections. For example, Ajiboye et al. (2013) described an online voting system used at Ladoke Akintola University of Technology in Nigeria, featuring candidate registration, voter authentication, and real-time result updates. Similarly, Ayo and Babajide (2015) presented a secure voting system at Covenant University, incorporating biometric authentication and a centralized database to prevent multiple voting and result tampering.

#### **Features of Existing Systems**

According to Gupta et al. (2020), most online voting systems include:

* User authentication, often with student IDs or biometrics.
* Secure data transmission using encryption.
* Vote storage in secure databases, with automatic vote counting.
* Real-time or near-real-time result display.

#### **Security Measures in Existing Systems**

Akinyede and Adesina (2017) discussed several security measures:

* Data encryption during transmission and storage.
* Multi-factor authentication for voters.
* Audit trails to track system activities.
* Distributed systems to prevent a single point of failure.

#### **Challenges Faced by Existing Systems**

Despite advancements, systems still face challenges, such as ensuring voter privacy, protecting against cyberattacks, and maintaining verifiability without compromising secrecy (Sukhwani et al., 2019). Digital access remains another issue, especially ensuring that all voters can use the system.

#### **Innovative Approaches**

Recent approaches include blockchain-based voting systems, like those proposed by Wang et al. (2018), which provide transparency and secure voting records. Ali and Murray (2016) also suggested using homomorphic encryption to count votes without revealing individual ballots, enhancing privacy.

These insights from existing systems highlight both the strengths and potential areas for improvement in developing an online voting system for Chuka University.