**Chapter ONE**

**Introduction**

**1.1 Background to the Study**

In the modern era, technology has permeated almost every aspect of human life, including governance and decision-making processes. Voting is a fundamental democratic process that allows citizens to participate in the selection of their representatives and the decision-making process. Traditionally, voting has been conducted using paper-based systems, which can be time-consuming, prone to errors, and vulnerable to manipulation. Voting is a cornerstone of democratic societies, providing citizens with the opportunity to participate in decision-making processes and elect their representatives. However, traditional paper-based voting systems have been plagued with numerous challenges, including inefficiency, errors, and vulnerabilities to fraud. As technology continues to advance, electronic voting (e-voting) systems have emerged as a potential solution to address these issues and improve the overall voting experience (Kreischer & Krimmer, 2021).

E-voting systems leverage technology to facilitate the casting and counting of votes electronically, offering advantages such as increased efficiency, accuracy, and transparency. These systems can streamline the voting process by automating various tasks, including vote casting, counting, and result announcement. Moreover, e-voting systems can enhance the accuracy of the voting process by minimizing human errors and eliminating the need for manual vote counting. Furthermore, they can provide transparency by enabling voters and stakeholders to verify and audit the voting results (Magkos & Mentzas, 2021).

Recent studies have emphasized the importance of implementing e-voting systems to enhance the integrity and efficiency of democratic processes. For instance, a research paper by Hanandeh *et al.* (2021) highlighted the benefits of e-voting systems, including reduced voting time, increased accessibility, and improved accuracy. The study also emphasized the need for robust security measures to protect against potential threats and ensure the credibility of the e-voting system.

In the context of educational institutions, student organizations often conduct elections to select their representatives and leaders. The National Association of Computer Science Students (NACOSS) at the Federal Polytechnic, Mubi, is one such organization that recognizes the limitations of the traditional paper-based voting system. The existing system poses challenges such as time-consuming vote counting, difficulties in verifying votes, and the potential for fraudulent activities.

To address these challenges and provide a more efficient and transparent voting process, the design and implementation of an e-voting system tailored to the specific requirements of NACOSS at the Federal Polytechnic, Mubi, is essential. By adopting an e-voting system, NACOSS can streamline the voting process, improve accuracy, and enhance transparency.

**1.2 Problem Statement**

The NACOSS (National Association of Computer Science Students) at the Federal Polytechnic, Mubi, recognizes the need to modernize their voting system. The existing paper-based voting system used by NACOSS at the Federal Polytechnic, Mubi, suffers from several limitations and challenges. These include:

1. Time-consuming processes: The manual counting of votes and the compilation of results can be a time-consuming task, causing delays in announcing the final results.
2. Error-prone: Manual data entry and vote counting processes are susceptible to human errors, which can compromise the accuracy and reliability of the election results.
3. Verification challenges: With a paper-based system, it can be challenging to verify the authenticity and integrity of votes, leading to doubts and disputes regarding the election outcomes.
4. Potential for fraud: Paper-based systems are vulnerable to various fraudulent activities, such as ballot stuffing or tampering with ballot boxes, which can undermine the credibility and fairness of the elections.
5. One person can vote more than one time.

**1.3 Aim and Objectives**

The aim of this project is to design and implementation of an e-voting system for NACOSS, Federal Polytechnic, Mubi. The specific objectives of this study are as follows:

1. To design an e-voting system tailored to the specific requirements of NACOSS, Federal Polytechnic, Mubi.
2. To implement the e-voting system and ensure its usability, reliability, and security.
3. To evaluate the effectiveness of the e-voting system in terms of efficiency, accuracy, and transparency.
4. To control over voting.

**1.4 Significance of the Study**

The successful design and implementation of an e-voting system for NACOSS, Federal Polytechnic, Mubi, will bring several benefits. Firstly, it will streamline the voting process, saving time and effort for both the voters and the organizers. Secondly, it will enhance the accuracy of the voting system by minimizing errors and eliminating manual counting procedures. Thirdly, the system will provide transparency, allowing for easy verification and auditing of votes, thereby increasing trust in the electoral process. Finally, the implementation of an e-voting system will serve as a model for other institutions and organizations seeking to modernize their voting systems.

**1.5 Scope of the Study**

This study focuses specifically on the design and implementation of an e-voting system for NACOSS at the Federal Polytechnic, Mubi. The system will be tailored to meet the unique requirements and constraints of the organization. However, it is important to acknowledge that the successful adoption of the system relies on various factors, including infrastructure availability, user acceptance, and cybersecurity measures. Therefore, this study does not address these external factors but primarily focuses on the technical aspects of the e-voting system.

**1.6 Definition of Some Operational Terms**

**Database**: In the context of an e-voting system, the database stores and manages various information, including voter details, candidate profiles, voting transactions, and other relevant data necessary for the voting process (Magkos & Mentzas, 2021).

**Electronic Voting (E-Voting):** Electronic voting, commonly referred to as e-voting, is a voting method that employs electronic systems and technologies to facilitate the casting and counting of votes (Magkos & Mentzas, 2021).

**Result**: The result refers to the outcome of an election, indicating the final tally of votes for each candidate or option. In the context of an e-voting system, the result is determined by aggregating and analyzing the recorded votes from the database (Kreischer & Krimmer, 2021).

**Security**: Security in the context of e-voting systems refers to the measures and protocols implemented to protect the integrity, confidentiality, and availability of the voting process and data (Jain & Jain, 2021).

**System**: In the context of this study, a system refers to the e-voting system designed and implemented for NACOSS at the Federal Polytechnic, Mubi. It encompasses the hardware, software, and associated components that enable the electronic casting, storage, and processing of votes (Kreischer & Krimmer, 2021).

**Transparency:** Transparency in e-voting systems refers to the openness and visibility of the voting process and the ability to verify and audit the election results (Kreischer & Krimmer, 2021).

**Usability**: Usability refers to the extent to which a system or software is user-friendly, intuitive, and easy to use (Schürmann & Krimmer, 2021).

**Votes**: In an e-voting system, votes are cast electronically by the voters through the designated interfaces or platforms provided by the system (Jain & Jain, 2021).

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.1 Introduction**

This chapter provides a comprehensive review of the existing literature related to e-voting systems. It examines studies, research articles, and relevant publications that contribute to the understanding of e-voting technologies, their implementation, challenges, and best practices. The literature review serves as a foundation for the design and implementation of an e-voting system for NACOSS at the Federal Polytechnic, Mubi.

**2.2 Overview of E-Voting Systems**

**2.2.1 Definition and Components of E-Voting Systems**

E-voting systems refer to the use of electronic technologies and systems to facilitate the casting, storage, and processing of votes in an election. These systems consist of various components, including hardware, software, databases, and user interfaces. The hardware components can include voting machines, ballot scanners, and biometric devices, while the software components encompass the applications and algorithms that manage the voting process (Kreischer & Krimmer, 2021).

E-voting systems consist of several essential components:

1. Hardware: E-voting systems require hardware components such as electronic voting machines, ballot scanners, biometric devices, and other peripherals. These devices are used by voters to interact with the system and cast their votes (Kreischer & Krimmer, 2021).
2. Software: The software component of an e-voting system includes the applications, algorithms, and protocols that facilitate the entire voting process. This encompasses the user interfaces for casting votes, data encryption and decryption mechanisms, database management systems, and result tabulation algorithms (Klemenc & Volk, 2021).
3. Database: A database is a crucial component of an e-voting system. It serves as a central repository for storing and managing various data related to the election, including voter registration details, candidate profiles, and voting transactions. The database ensures the integrity and security of the stored information (Magkos & Mentzas, 2021).
4. User Interfaces: E-voting systems offer different user interfaces to facilitate vote casting. These interfaces can be in the form of touch screens on voting machines, web-based interfaces for internet voting, or mobile applications for mobile voting. User interfaces need to be intuitive, user-friendly, and accessible to voters with varying levels of technical proficiency (Schürmann & Krimmer, 2021).

**2.2.2 Types of E-Voting Systems**

E-voting systems can be categorized into different types based on their implementation methods:

1. Machine-based voting systems: This type of e-voting system utilizes dedicated electronic voting machines located at polling stations. Voters interact with these machines to cast their votes. Machine-based systems may utilize touch screens, buttons, or other input mechanisms for vote selection (Klemenc & Volk, 2021).
2. Internet-based voting systems: Internet voting systems allow eligible voters to cast their votes remotely using secure online platforms. Voters can access the system through their personal devices, such as computers or smartphones, and cast their votes from any location with an internet connection (Kreischer & Krimmer, 2021).
3. Mobile-based voting systems: Mobile voting systems leverage mobile applications to enable voters to cast their votes using their smartphones or other mobile devices. These systems often employ encryption and secure communication protocols to ensure the confidentiality and integrity of votes (Jain & Jain, 2021).

## 2.3 Information system

Information systems are starting to become indistinguishable from communication systems. Some of the many different ways that will change healthcare are the way communication occurs and to the change it will have upon the doctor-patient relationship. For optimum performance of telemedicine, three aspects of the management of the medical records for teleconsultations are particularly important: multimedia collection, standardization of patient record identification and classification, and information management (Lian, Chong, Zhai & Ning, 2013).

## 2.4 Web-portal

A web portal is a specially designed website that brings information from diverse sources, like emails, online forums and search engines, together in a uniform way. Usually, each information source gets its dedicated area on the page for displaying information (a portlet); often, the user can configure which ones to display. The extent to which content is displayed in a "uniform way" may depend on the intended user and the intended purpose, as well as the diversity of the content. Very often design emphasis is on a certain "metaphor" for configuring and customizing the presentation of the content (e.g., a dashboard or map) and the chosen implementation framework or code libraries (Richard, 2016).

In addition, the role of the user in an organization may determine which content can be added to the portal or deleted from the portal configuration. A portal may use a search engine's Application Programming Interface (API) to permit users to search intranet content as opposed to extranet content by restricting which domains may be searched. Apart from this common search engines feature, web portals may offer other services such as e-mail, news, stock quotes, information from databases and even entertainment content. Portals provide a way for enterprises and organizations to provide a consistent "look and feel" with access control and procedures for multiple applications and databases, which otherwise would have been different web entities at various URLs. The features available may be restricted by whether access is by an authorized and authenticated user (employee, member) or an anonymous website visitor (Navjot & Supriti, 2019).

Raenu and Rafidah (2013), point out that portal is a Web site which acts as a starting point or ‘gateway’ and provides a wide variety of resources, services, tasks and links to other websites. Among those resources there are search engines, news, e-mail, discussion groups, online shopping, references and so on. This type of portals, sometimes called horizontal portals (Babie, 2014), is generally offered by Internet Service Providers or search engines. Yahoo! is an example, with an index to a lot of services, that is, the first screen that a user will see when going online, a place to go to find an organized view of the online information space.

More specialized portals, sometimes called vertical portals (Rao, 2013), are those addressed to a specific interest or field, for example portals with the aim at medical information. The, users can get information about clinical trials, professional directories, patient forums, support groups, health articles, health care associations, and so on. Even more specialized portals, enterprise portals deliver organization wide information in a user centric manner, based on user authentication they offer customized services to specific users, employees, customers, and the like. They offer support for tasks, workflow, groupware, and the creation and integration of knowledge. In this last category, we can find, for example, the employee portal of an institution. The, employees, in general, can access their salaries, information about their medical insurances, and the like, and, more specifically, research staff can access a service to complete their curriculum vitae, forms to request financial support for research, and so on. Personal portals are also distinguished. They are customized by the user and typically are associated with a search engine and display selected information such as news, weather, dictionaries and so on. Google and My Yahoo are examples of this type of portals.

**2.5 Database Management System**

**2.5.1 Definition of Database Management System (DBMS)**

A Database Management System (DBMS) is software that enables the creation, organization, management, and retrieval of data in a structured manner. It provides a systematic approach to store, update, and retrieve data from a database, ensuring data integrity, security, and efficient access. DBMS serves as an essential component of e-voting systems, facilitating the storage and management of various data related to the election process (Elmasri & Navathe, 2020).

**2.5.2 Components of a Database Management System**

A DBMS consists of several components that work together to manage the database effectively:

**Data Definition Language (DDL):** DDL is used to define and specify the database structure and schema. It allows the creation, modification, and deletion of database objects such as tables, views, and indexes.

**Data Manipulation Language (DML):** DML enables users to interact with the database by performing operations such as inserting, updating, and deleting data records. It provides a set of commands and operations to retrieve and manipulate data stored in the database.

**Data Query Language (DQL):** DQL is used to retrieve specific data from the database based on user-defined queries. It allows users to specify search criteria, sort data, and extract information from the database.

**Data Control Language (DCL):** DCL defines and manages access control and security mechanisms for the database. It includes commands to grant or revoke permissions, define user roles, and enforce data security policies.

Database Transaction Management: DBMS provides transaction management capabilities to ensure the integrity and consistency of data. It supports transactional operations, including transaction initiation, commit, rollback, and concurrency control to manage concurrent access to the database.

Database Recovery and Backup: DBMS includes mechanisms for data recovery and backup to protect against data loss or system failures. It allows for the restoration of the database to a previous consistent state in case of failures.

**2.5.3 Importance of Database Management in E-Voting Systems**

In the context of e-voting systems, the database management system plays a critical role in storing and managing various data related to the election process. It ensures the integrity and security of the stored information and provides efficient access to retrieve and process the data. Key aspects of the database management system in e-voting systems include:

**Voter Registration:** DBMS manages the voter registration process, storing voter details such as names, identification numbers, and eligibility status. It allows for efficient verification of voter credentials during the voting process.

**Candidate Profiles:** DBMS stores information about the candidates participating in the election, including their names, party affiliations, and other relevant details. This data is retrieved and presented to the voters during the voting process.

**Vote Recording:** DBMS records and stores the votes cast by each voter, ensuring accuracy and integrity. It allows for the retrieval and aggregation of votes for result tabulation.

**Auditability:** DBMS provides mechanisms for auditing and maintaining a trail of all activities related to the database. It enables the tracking of changes, ensuring transparency and accountability in the e-voting process.

**Data Security:** DBMS incorporates security measures to protect the database from unauthorized access, tampering, or data breaches. It includes encryption techniques, access control mechanisms, and data backup strategies to ensure data confidentiality and integrity.

**2.6 Related Literatures**

Al-Nashif and Milutinovic (2020), proposed an e-voting system based on blockchain technology, which aims to enhance the security, transparency, and integrity of the voting process. It discusses the design and implementation of the system and evaluates its effectiveness in ensuring secure and tamper-resistant voting.

Dhamija and Dhamija (2020) in their study presents an e-voting system that employs a homomorphic encryption scheme to ensure the privacy and integrity of votes. It discusses the implementation of the system and evaluates its performance and security properties, highlighting the advantages of using homomorphic encryption in e-voting systems.

Garcia *et al*. (2021), proposed an e-voting system that utilizes biometric authentication for secure and accurate voter identification. It discusses the design principles, implementation details, and evaluation of the system, emphasizing the advantages of biometric-based authentication in preventing voter fraud and ensuring the integrity of the voting process.

Osorio (2020), presents an e-voting system that combines blockchain technology and blind signature techniques to enhance the security and anonymity of votes. It discusses the design and implementation of the system and evaluates its effectiveness in ensuring transparent and tamper-resistant voting.

Trabelsi *et al*. (2020), proposes a secure e-voting system that leverages the Internet of Things (IoT) and blockchain technology. It discusses the integration of IoT devices for voter authentication and the use of blockchain for secure vote recording and verification. The study evaluates the system's security properties and highlights the potential of IoT and blockchain in e-voting systems.

These related studies offer insights into various approaches and technologies used in e-voting systems, including blockchain, encryption schemes, biometric authentication, and IoT. They provide valuable contributions to the design, implementation, and evaluation of secure, transparent, and efficient e-voting systems.

**2.5 Summary**

This chapter has provided a comprehensive literature review on e-voting systems, including their definition, components, types, benefits, and challenges. It has also highlighted best practices in system design and implementation and presented case studies of successful e-voting implementations in various countries. The findings from this literature review will inform the design and implementation of an e-voting system tailored to the specific requirements of NACOSS at the Federal Polytechnic, Mubi.

# **CHAPTER THREE**

# **SYSTEM DESIGN AND ANALYSIS**

## 3.1 Introduction

This chapter presents the design and implementation details of the Electronic Voting (E-Voting) system for the National Association of Computer Science Students (NACOSS) at Federal Polytechnic, Mubi. This chapter contains the system design and analysis of the proposed system, the disadvantages of the existing system, the advantages of the proposed system over the existing system, the requirements (Hardware and Software), the design and the system architecture.

## 3.2 Disadvantages of the Existing System

The existing system of manual voting used by NACOSS at Federal Polytechnic, Mubi has several disadvantages. Manual voting processes are often time-consuming, particularly during large-scale elections. Voters need to physically travel to the polling stations, wait in queues, and manually mark their ballots. This process can result in long waiting times and delays in vote counting. Manual voting is susceptible to human errors. Both voters and electoral staff may make mistakes while marking the ballots or recording the votes. These errors can lead to inaccurate vote counts and potentially impact the election results. The existing system of voting poses challenges for individuals with disabilities or those who are unable to travel to the polling stations. Manual voting systems are vulnerable to security risks such as ballot tampering, fraudulent activities, or misplacement of ballots. Without robust security measures, it becomes difficult to ensure the integrity and confidentiality of the voting process. Manual voting processes may lack transparency, making it challenging for stakeholders to verify the fairness and accuracy of the election results. Without a clear audit trail, it becomes challenging to track and resolve any discrepancies or disputes that may arise.

**3.3 Advantages of the Proposed System**

The proposed E-Voting system for NACOSS at Federal Polytechnic, Mubi offers several advantages over the existing manual voting system. Some of the key advantages of the proposed system are:

1. Increased Efficiency
2. Enhanced Accuracy
3. Improved Accessibility
4. Enhanced Security
5. Improved Transparency
6. Cost-effective
7. Efficient Data Management

## 3.4 The Proposed Method

The waterfall model is a traditional sequential approach to software development that consists of distinct phases that follow a linear sequence. Here is a simplified version of the waterfall model for the development of an E-Voting system for NACOSS at Federal Polytechnic, Mubi:

**Requirements Gathering and Analysis:**

1. Identify the requirements and objectives of the E-Voting system.
2. Conduct interviews and discussions with stakeholders to understand their needs.
3. Define the system's functionalities, user roles, and security requirements.

**System Design:**

1. Design the system architecture, including the client-side and server-side components.
2. Create the database schema and define the data model.
3. Develop the user interface design, considering usability and accessibility.

**Implementation:**

1. Develop the client-side application using web technologies like HTML, CSS, and JavaScript.
2. Implement the server-side application using a suitable programming language and framework.
3. Integrate the user interface with the backend functionalities.
4. Implement security measures such as encryption, authentication protocols, and access control.

**Testing:**

1. Conduct unit testing to verify the correctness of individual components.
2. Perform integration testing to ensure the proper functioning of the system as a whole.
3. Carry out system testing to validate the system against the defined requirements.
4. Perform security testing to identify and address any vulnerabilities.

**Deployment:**

1. Prepare the system for deployment by configuring the necessary infrastructure and servers.
2. Install and set up the required software and dependencies.
3. Migrate the database and ensure data integrity.
4. Conduct user acceptance testing to gain feedback and ensure readiness for production use.

**Maintenance and Support:**

1. Provide ongoing maintenance and support for the E-Voting system.
2. Address any reported issues, bugs, or security vulnerabilities.
3. Perform regular system updates and enhancements based on user feedback and changing requirements.
4. Ensure the system remains secure, reliable, and up-to-date.



Figure 3.1: Waterfall model

## 3.5 Method of Data Collection

This study will adopt two methods of data collection:

**Primary Source:** Primary source refers to the sources of collecting original data in which the researcher makes use of empirical approach such as personal interview, questionnaires or observation.

**Secondary Source:** The need for the secondary sources of data for this kind of project cannot be over emphasized. The secondary data were obtained from magazines, Journal, newspapers, library source and most of the information from the library research has been covered in the literature review section.

## 3.6 System Design

Systems design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development.

## 3.6.1 Algorithm Diagram

**Use case diagram**

A use case diagram at its simplest is a representation of a user’s interaction with the system and depicting the specifications of a use case. A use case diagram shows the system and the various ways that they interact with the system.

Registration

Login

Add Candidates

Add voter

Cast vote

Admin

Voter

Create Election

Add Position

Update System information

Print report

Display Result

Log out

Figure 3.2: Use case diagram

**Activity Diagram**

An activity diagram shows a flow of control in a system similar to a flowchart or a data flow diagram.

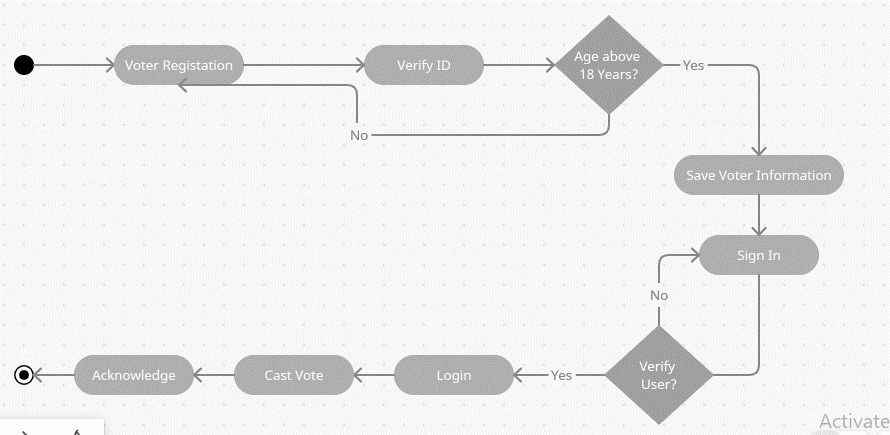


Figure 3.3: Activity Diagram for E-voting system

**3.6.2 System Architecture**

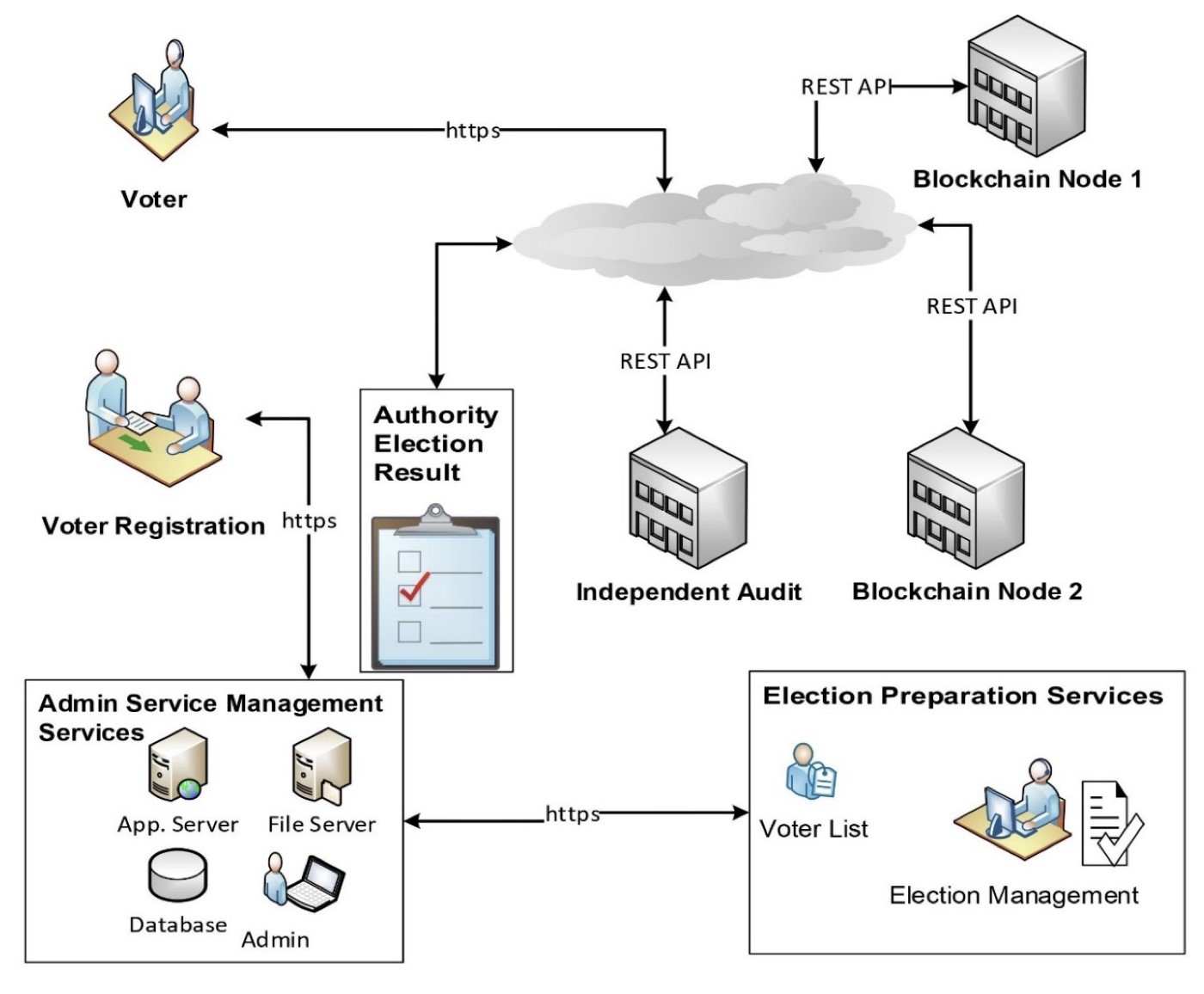


Figure 3.4: System architecture

## 3.6.3 Database Tables/Queries Structures

The database is used to store all information that pertain the food ordering records. Below are the database table for the new system.

**Table 1: Admin Table**

Top of Form

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| id Primary | int(11) | AUTO\_INCREMENT |
| username | varchar(250) |  |
| firstname | varchar(250) |  |
| lastname | varchar(250) |  |
| photo | varchar(250) |  |
| password | varchar(250) |  |
| Created\_on | Time\_stamp |  |

**Table 2: Candidates table**

**Top of Form**

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| id Primary | int(11) | AUTO\_INCREMENT |
| Position\_id | int(11) |  |
| firstname | varchar(250) |  |
| lastname | varchar(250) |  |
| photo | varchar(250) |  |
| association | varchar(250) |  |
| Created\_on | Time\_stamp |  |

**Table 3: position Table**

Top of Form

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| id Primary | int(11) | AUTO\_INCREMENT |
| description | varchar(250) |  |
| Max\_vote | varchar(250) |  |
| priority | varchar(250) |  |

Bottom of Form

**Table 4: Votes table**

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| id Primary | int(11) | AUTO\_INCREMENT |
| Position\_id | int(11) |  |
| Candidate\_id | int(11) |  |
| Voters\_id | int(11) |  |

**Table 5: Voters Table**

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| id Primary | int(11) | AUTO\_INCREMENT |
| voters\_id | int(11) |  |
| firstname | varchar(250) |  |
| lastname | varchar(250) |  |
| photo | varchar(250) |  |
| level | varchar(250) |  |
| Created\_on | Time\_stamp |  |

Top of Form

Bottom of Form

## 3.6.4 Entity Relationship Modelling

An Entity Relationship (ER) Diagram is a sort of flowchart that shows how "entities" in a system, such as people, things, or concepts, interact with one another. ER Diagrams are most commonly used in the disciplines of software engineering, corporate information systems, education, and research to build or troubleshoot relational databases.

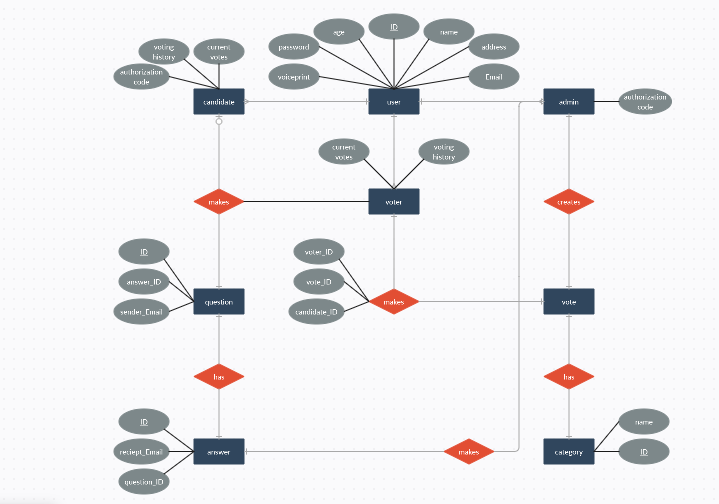


Figure 3.5: Entity Relationship Model

## 3.6.5 Database Entity Relationship Diagram

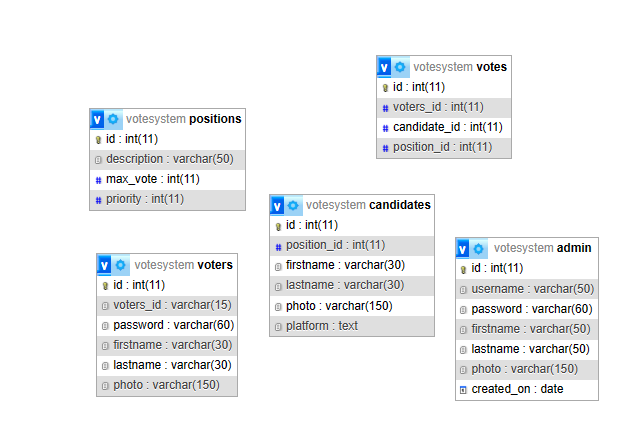


Figure 3.4: Entity Relationship Diagram

## 3.6.6 Input and Output Design

**ADD NEW VOTER**

First Name

Last Name

Photo

Password

UNIQUE CODE

**SAVE**

**CLOSE**

Figure 3.5: Registration Form

**LOGIN FORM**

username

password

**Register Now!**

**LOGIN**

Figure 3.6: Login form

**ADD NEW CANDIDATE**

First Name

Last Name

Photo

Position

Association

**SAVE**

**CLOSE**

**SAVE**

**CLOSE**

Figure 3.7: Order Form

**ADD NEW POSITION**

Description

Maximum vote

Figure 3.8: Add New Position

**BALLOT FORM**

**PRESIDENT**

**You can only select 1 candidate**

**RESET**



SUNDAY PHILIP

MODEY WISDOM



**BALLOT FORM**

**SECRETARY GENERAL**

**You can only select 1 candidate**

**RESET**



USENI BASHERU

DAUDA WASINDA





EMMANUEL MOSES

Figure 3.9: Election ballot form

**ELECTION TITLE**

Election Title

**SAVE**

**CLOSE**

Figure 3.10: Election Title

## 3.7 System Requirement Specification

## 3.7.1 Hardware Requirements

The software to be design needs the following hardware for an effective operation of the newly designed system.

1. A system running on intel, P(R) duo core with higher processor
2. The-Random Access Memory (RAM) should be at least 512MB.
3. At least 20-GB hard disk.
4. A monitor.

## 3.7.2 Software Requirements

The software requirements include:

1. A window 7 or higher version of operating system.
2. XAMP or WAMP for Database
3. PHP
4. MySQL
5. Browser

## 3.7.3 Personnel Requirements

Any computer literate who has a technical knowhow of internet surfing can use the system because it is user friendly.

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