SMART BALLOT: ENHANCING ELECTORAL MANAGEMENT EFFICIENCY

A Capstone Project

Presented to the

Faculty of the Department of Information Technology

College of Engineering

Eastern Visayas State University

Tacloban City

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science in Information Technology

By

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June 2025

APPROVAL SHEET

The Capstone Project Study entitled **SMART BALLOT: ENHANCING ELECTORAL MANAGEMENT EFFICIENCY** prepared and submitted by Jude Daniel A. Chu, John Chrysler G. Nacasabug in partial fulfillment of the requirements for the degree of BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY has been examined and is recommended for acceptance and approval for FINAL DEFENSE.

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ACKNOWLEGEMENT

The completion of Smart Ballot: Enhancing Electoral Management Efficiency was made possible by the unwavering support of various individuals and organizations.

The researchers express sincere gratitude to Almighty God for inspiration, strength, and guidance. Heartfelt appreciation goes to parents, friends, and the Eastern Visayas State University for steadfast support and resources.

Special thanks to advisers and panelists for expertise and feedback that shaped the project. The researchers deeply appreciate the cooperation of Student Affairs and Services Office (SASO) and all contributors.

This project's success was attributed to the collected effort of those mentioned, and the researchers are privilege to contribute to the technological of manual to systematic process of EVSU SASO in Tacloban City.

J.D.A.C

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Chu, Jude Daniel A.; Nacasabug, John Chrysler G. "Smart Ballot: Enhancing Electrocal Management Efficiency" (Eastern Visayas State University, December 2024, Tacloban City)

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This project aimed to develop a Smart Ballot System for the Eastern Visayas State University (EVSU) campus to streamline the electoral process, particularly the registration, verification, and voting stages. Traditional manual methods for verifying voter identity and counting votes have been time-consuming and prone to human error, which increases the strain on election officers. This research focuses on automating these processes through email verification, QR code generation, and real-time vote tallying. The system was designed to reduce the administrative burden on election officers by providing an accurate, faster, and transparent process for voter verification and vote counting. The primary objective of the project is to modernize the existing election process by automating student verification and vote tallying. The Smart Ballot System utilizes QR codes for secure verification and vote submission, automatically recording the votes and generating real-time results. This automation eliminates the need for manual vote tallying, significantly improving accuracy and efficiency. Additionally, the system ensures a secure and transparent process for managing election results, making it easier for officers to handle and verify the outcomes. The study's findings indicate that the system increased efficiency, reduced human errors, and sped up the reporting process, ultimately contributing to a more reliable electoral system at EVSU. The implementation of this system has broader implications for future electoral processes at EVSU, with potential for adaptation in other educational institutions or communities. The Smart Ballot System is a step toward integrating

modern technology into civic processes, offering a solution that enhances both accuracy and transparency in elections.

Keywords: Smart Ballot System, QR Code Verification, Vote Tallying Automation, Election Process Modernization, Real-time Vote Submission, Electoral Transparency, Secure Voting System, Digital Election Process.

Chapter I

INTRODUCTION

Information and Communication Technology (ICT) has become a cornerstone in enhancing educational systems worldwide by improving learning processes, administration, and sustainability (Al-Rahmi & Othman, 2013). The integration of ICT tools positively influences students' learning experiences and academic performance, contributing significantly to education sustainability (Voogt et al., 2015). This importance extends across educational levels, benefiting both secondary and tertiary students by facilitating access to digital resources and streamlining administrative tasks.

In the context of academic elections, universities in the Philippines face challenges including security risks, transparency issues, and fluctuating voter participation rates (De Leon, 2019). Traditional manual voting methods are often prone to errors, delays, and low engagement, impeding the democratic process within educational institutions (Kshetri, 2021). As voter turnout varies across departments, the need for more efficient and trustworthy systems becomes evident.

Electronic voting (e-voting) systems offer promising solutions to these challenges by enhancing vote accuracy, ensuring data integrity, and accelerating result processing (Alvarez et al., 2009). Nonetheless, such systems must be carefully designed to maintain transparency, privacy, and security to build trust among users (Chaum et al., 2008).

This project aims to resolve key problems in the manual election system at Eastern Visayas State University: the time-intensive and error-prone recording of votes, laborious vote tallying, and insufficient voter turnout caused by lack of awareness and motivation. By implementing an automated digital voting system, vote collection and counting can be streamlined, human errors minimized, and real-time results ensured. Additionally, integrating awareness campaigns and user-friendly digital platforms will foster higher student engagement and promote democratic participation.

Objectives of the Project

The general objective of this project is to enhance the electoral management system for the Eastern Visayas State University, specifically for the Student Affairs and Services Office (SASO), by developing a Smart Ballot System.

The specific objectives are as follows:

1. To provide a comprehensive system for voter registration and management, ensuring that the electoral process is streamlined and accessible.
2. To verify voter eligibility, our system will utilize a unique voting QR code.
3. To develop a system that scans a QR code sent via email, directing users to an online voting form for immediate vote submission and accurate tallying.

Scope and Delimitations of the Project

The scope of the project covers the registration, email verification, QR code generation, and automated voting process. The system focuses on streamlining student verification through email, generating unique QR codes for each student, and providing an efficient method for tallying and counting votes. This process is designed to assist the election committee and relevant staff in ensuring a seamless and secure election process.

The delimitation of the project was established to ensure the system's implementation remains within the university level and does not extend to functions outside the scope of this study, such as nationwide or external voting systems.

Significance of the Project

The project is significant towards improving the process of managing votes of the university and managing students' eligibility to vote. This initiative aims to streamline the voting process within Eastern Visayas State University, specifically for the Student Affairs and Services Office (SASO). By

integrating a smart ballot system, the project enhances the accuracy, transparency, and efficiency of the electoral process, ensuring that every student's vote is correctly accounted for and reducing the potential for errors and fraud.

University Administration. The university administration will benefit from a more efficient and transparent electoral process, which can enhance the institution's reputation for innovation and integrity.

Student Affairs & Service Offices. The staff and other relevant staff would be able to use the system to manage and access the votes of the students more efficiently and accurately, simplifying the workload and ensuring reliable vote counts.

Student Supreme Government Officers. They can utilize the candidate webpage, with a simple and easy UI, to effectively communicate their background, ideals, and plans. This encourages higher participation rates and ensures that elected representatives reflect the student body's preferences.

Students. The students will be able to vote quickly and identify possible candidates in the voting process, making it more streamlined. This will result in a more convenient voting process with reduced wait times and access to detailed candidate information, fostering informed voting and greater engagement.

Researchers. Tech experts who set up and maintain the voting system will have opportunities for innovation, data analysis, and interdisciplinary collaboration. This contributes to academic knowledge and practical applications, enhancing the system's reliability and effectiveness.

Chapter II

THEORETICAL FRAMEWORK

Review of Related Literature

This review of related literature aims to provide a comprehensive overview of recent advancements and findings related to the integration of information and communication technology (ICT) in electoral processes. As the landscape of voting systems evolves, numerous studies have explored the impact of digital tools on the efficiency, transparency, and security of elections. This capstone project, which focuses on enhancing the voting system at Eastern Visayas State University, draws on these studies to build a solid foundation for implementing a modern, reliable, and user-friendly voting process.

Student Registration and Voter Management

Al-Rahmi et al. (2020) emphasized the effectiveness of digital platforms in automating processes within educational institutions. Their study found that digitized student data management improves administrative efficiency and accuracy. Applied to student elections, this means a structured database can help ensure only eligible voters are included in the official voter list. This principle supports the use of email-verified registration to validate and streamline the voter management process.

Email Verification for Voter Authentication

Although some systems incorporate biometric or smart card authentication for secure access (Sai et al., 2023; Verma et al., 2023), these methods require additional hardware and infrastructure. The proposed system relies instead on email verification, which provides a practical

and accessible alternative. It effectively prevents duplicate entries and unauthorized participation, making it suitable for campus-wide elections where simplicity and scalability are priorities.

Vote Submission and User Feedback

Singh (2024) designed an Arduino-based voting interface that provides real-time visual feedback upon vote submission, helping assure voters that their selections were properly recorded. Similarly, Patil et al. (2021) used LCD modules to confirm vote entries. While the current system does not involve physical displays, it provides confirmation through web-based alerts after a vote is submitted. This approach simplifies the user experience while maintaining clarity for the voter.

QR Code Recognition Using ESP32-CAM Modules in Identity Verification

An essential feature of the proposed smart ballot system is its use of a QR scanner, camera, and sensor (e.g., PIR or ultrasonic) to detect and validate ballots. Several studies and practical implementations have demonstrated the use of Arduino-compatible microcontrollers, such as the ESP32-CAM, in identity verification systems using QR code recognition.

A notable example is the project by Random Nerd Tutorials (2022), which developed a QR code reader system using the ESP32-CAM. This setup allowed continuous QR code scanning, logging user data with timestamps on a microSD card, and hosting a web interface to manage and review scanned records. The system confirmed the effectiveness of low-cost, standalone modules for secure QR-based verification workflows, closely resembling the approach intended for smart ballot systems.

Similarly, Circuit Digest (2022) showcased a prototype wherein the ESP32-CAM captures an image of a QR code and sends it to a cloud API for decoding. The decoded information was then displayed on an OLED module, demonstrating an efficient hardware-software integration for identity

recognition. This design reinforces the practicality of using camera-based embedded systems for accurate and reliable QR code scanning in automated validation systems.

These implementations validate the feasibility of the proposed system's architecture, which employs an ESP32-CAM to scan QR codes encoded with student information and ballot numbers. Such real-time authentication helps ensure that only valid and unique ballots are accepted, contributing to election integrity and preventing duplicate voting.

Real-Time Vote Tallying and Transparency

Al-jawaherry (2019) implemented a microcontroller-based voting machine capable of real-time vote counting, which eliminated the need for manual computations and increased stakeholder trust. Patil et al. (2021) also emphasized the importance of displaying live results to improve transparency. In the proposed system, automated tallying is handled on the server-side immediately after submission, making results readily available without the need for additional equipment.

Security and Data Integrity.

Ensuring secure handling of ballots is a core requirement of any election system. Iqbal and Rahman (2023) integrated encryption into their Arduino-based voting system to safeguard stored and transmitted votes. While the current system does not include encryption at the device level, it maintains data integrity through secure web protocols (e.g., HTTPS) and protected server environments. This ensures that votes are neither tampered with nor intercepted during transmission.

System Reliability and Overall Performance

Ismail et al. (2021) demonstrated a reliable Arduino-based voting system using infrared sensors, showing that even low-cost technologies can perform consistently in diverse conditions. Ikrissi and Mazri (2024) further reviewed critical challenges in electronic voting, such as trust, privacy, and legal limitations. While the proposed system avoids the complexity of physical sensors, it achieves dependable performance through validated web forms and structured back-end operations.

Conceptual Framework

The Smart Ballot System enhances the voting process for the SASO elections at Eastern Visayas State University by incorporating student verification through email, QR code scanning, and automated vote tallying. By incorporating email verification, the system ensures that students are properly authenticated. Once verified, students are issued a unique QR code, which they can scan to access the voting form. Upon submission, the system automatically counts and records the votes in real-time, ensuring accuracy and efficiency in the election process.

This framework contrasts the traditional voting process with the enhanced Smart Ballot System, highlighting the improvements in security, speed, and accuracy offered by the new system.

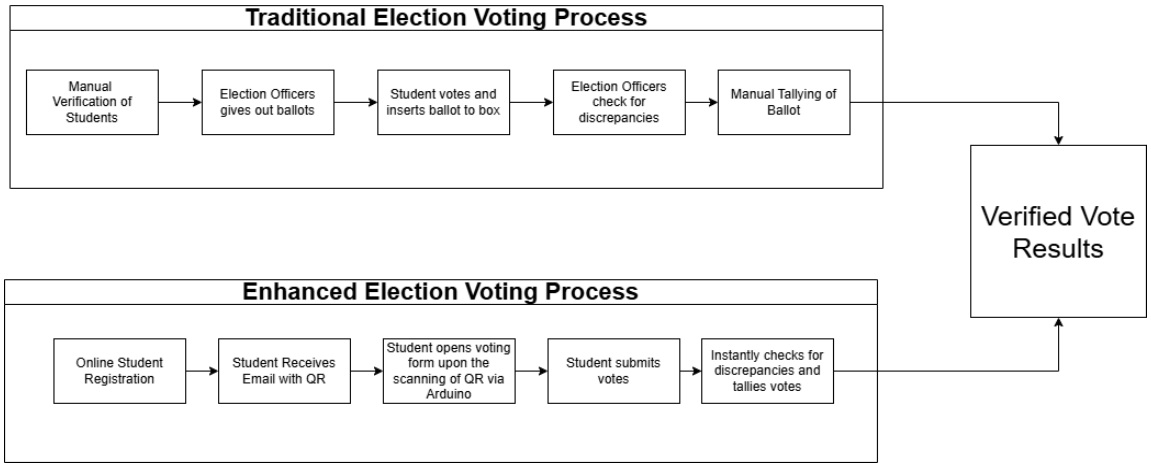


Figure 2-1. Conceptual Framework of the Study

The traditional election voting process involves manual student verification by election officials, who then issue paper ballots for students to mark and drop into a ballot box. After voting, officials manually count the ballots and check for discrepancies, leading to a time-consuming and error-prone process. This method relies heavily on human oversight to ensure accuracy, causing delays in announcing verified election results.

The enhanced election voting process begins with students registering their details in the system. A verification email is sent to confirm the student's identity. Once verified, a unique QR code for voting is sent out. The student scans the QR code to access the voting form. After making their selections, the student submits the form, and the system automatically counts the votes in real-time, ensuring efficiency and accuracy. This process minimizes human intervention, reduces errors, and offers real-time monitoring, guaranteeing a faster, secure, and tamper-proof election.

Definition of Terms

In the context of this capstone project, the integration of Information and Communication Technology (ICT) within the electoral process at Eastern Visayas State University aims to modernize and enhance the efficiency, transparency, and integrity of student government elections. To facilitate a comprehensive understanding, the following key terms are defined both conceptually and operationally, providing clarity on their specific application within this project.

Ballot Box. A sealed container into which voters put completed ballots (Cambridge Dictionary, 1963). In this project, the ballot box refers to the physical container for paper ballots before they are scanned and counted.

Ballot Scanning. The process of using an optical scanner to read and convert the choices marked on a paper ballot into digital data (Merriam-Webster Dictionary, 1984). In this project, ballot

scanning refers to the use of optical scanners to read and record votes from printed ballots, ensuring accurate and efficient vote tallying.

Data Encryption. The process of converting information or data into a code, especially to prevent unauthorized access (Cambridge Dictionary, 1978). In this project, data encryption ensures that the voting data is securely transmitted and stored.

Eligibility. The state of having the right to do or obtain something through satisfaction of the appropriate conditions (Cambridge Dictionary, 1809). In this project, eligibility refers to the criteria that students must meet to be allowed to vote, verified through ID and QR code authentication.

Electronic Voting (E-Voting). A method of casting votes using electronic systems, typically via computers or specialized voting machines (Oxford Dictionary, 2001). In this project, e-voting refers to the use of ICT to facilitate the casting and counting of votes.

Information and Communication Technology (ICT). Technologies that provide access to information through telecommunications, including the internet, wireless networks, cell phones, and other communication mediums (Oxford Dictionary, 2001). In this project, ICT encompasses the tools and systems used to facilitate electronic voting, including computers, network infrastructure, and software applications used by students and staff at Eastern Visayas State University.

Optical Scanner. A device that uses light to read and convert printed text or images into digital data (Merriam-Webster Dictionary, 1964). In this project, an optical scanner is used to read the marked choices on paper ballots and convert them into digital votes.

Polling Station. A designated location where voters go to cast their ballots in an election (Cambridge Dictionary, 1886). In this project, polling stations are the physical locations where students can cast their paper ballots before they are scanned.

QR Code. A type of matrix barcode (or two-dimensional barcode) that is a machine-readable optical label containing information about the item to which it is attached (Oxford Dictionary, 2010).

In this project, QR codes are used for voter authentication and verification, ensuring that each student's identity is securely validated before they can cast their vote.

Real-Time Monitoring. The process of continuously observing and recording activities as they happen (Merriam-Webster Dictionary, 1989). In this project, real-time monitoring refers to the ability to oversee the voting process as it occurs, ensuring transparency and immediate detection of any irregularities.

System Integrity. The state of a system being whole and unimpaired, maintaining accuracy and consistency over its entire lifecycle (Oxford Dictionary, 1993). In this project, system integrity refers to the assurance that the voting system operates correctly and reliably without unauthorized alterations.

Transparency. The extent to which all actions and processes are open and clear to all stakeholders, allowing them to verify that the process is fair and correct (Cambridge Dictionary, 1995). In this project, transparency refers to the ability of all participants to observe and verify the voting process, including real-time monitoring, auditing capabilities, and clear reporting of results.

Usability. The ease with which people can use a particular tool or system to achieve a specific goal (Merriam-Webster Dictionary, 1976). In this project, usability refers to how user-friendly and accessible the voting system is for students and staff.

User Interface (UI). The means by which the user and a computer system interact, in particular the use of input devices and software (Oxford Dictionary, 1966). In this project, the user interface refers to the graphical layout of the e-voting system that students interact with to cast their votes and verify their selections.

Voter Anonymity. The principle that the identity of a voter should not be revealed in the voting process (Oxford Dictionary, 1951). In this project, voter anonymity ensures that votes are cast in secret, protecting the privacy of the voters.

Voter Registration. The process by which eligible voters are identified and added to the list of people who are allowed to vote (Cambridge Dictionary, 1912). In this project, voter registration involves collecting and verifying the information of students who are eligible to vote.

Voting Rights. The legal rights guaranteeing that eligible individuals can participate in the election process (Merriam-Webster Dictionary, 1948). In this project, voting rights ensure that all eligible students can vote in the Student Affairs and Services Office (SASO) elections.

Vote Tallying. The process of counting and summing up votes cast in an election to determine the outcome (Cambridge Dictionary, 1963). In this project, vote tallying refers to the automated process of aggregating votes from the scanned ballots and calculating the election results.

Workflow Automation. The design, execution, and automation of processes where tasks, information, or documents are passed between people or systems according to predefined rules (Oxford Dictionary, 1998). In this project, workflow automation refers to automating the steps involved in the voting process to improve efficiency and accuracy.

Zero Trust Security. A security concept centered around the belief that organizations should not automatically trust anything inside or outside their perimeters and instead verify anything and everything trying to connect to their systems before granting access (Merriam-Webster Dictionary, 2016). In this project, zero trust security ensures that only authenticated and authorized users can access the voting system.

Chapter III

OPERATIONAL FRAMEWORK

This chapter outlines the operational framework of the proposed SMART BALLOT: ENHANCING ELECTORAL MANAGEMENT EFFICIENCY. It addresses essential aspects like resources, the client's environment, the study's location, the method and flowchart used in the study. It also delves into detailed aspects of materials, system environment, methods, analysis, design, implementation, testing, deployment, and evaluation to offer a comprehensive understanding of the project.

Materials

The materials utilized in the development of the system covers the software, hardware, data and other contents providing a straightforward look at the key elements in the operational framework of the system. By understanding the said materials for creating an efficient and effective system to improve the electoral process of the university.

Software

The table below shows the software use for developing the system. Software tool such as PHP and MySQL used for the backend of the database that manages all the data in the process.

Table 3-1. Software Specifications

SOFTWARE	DESCRIPTION
Arduino IDE	An open-source platform used for writing and uploading code to Arduino boards.
Flask	Flask is a lightweight and flexible web framework for Python, designed to help developers build web applications quickly and

	with minimal overhead. It offers core features like routing and templating, while allowing easy extension with third-party libraries.
Visual Studio Code	A free, open-source code editor from Microsoft, featuring debugging, syntax highlighting, intelligent code completion, and version control.
MySQL	An open-source relational database management system used for storing and managing data in web applications.
Mailjet	Mailjet is an email delivery service that allows businesses to send, receive, and track emails. It provides features like email templates, SMTP integration, and analytics to optimize email marketing and transactional communications.

Hardware

The table below specifies the vendor and basic hardware specifications of the devices used in developing the system.

Table 3-2. Hardware Specifications

HARDWARE	SPECIFICATIONS
Computer	AMD Ryzen 5 3600 6-Core Processor 3.60 GHz Windows 10 Home 16.0 GB DDR4 RAM

	Nvidia GeForce GTX 1650
ESP32 CAM	512 kb Internal + 4MB External PSRAM OV2640 2MP Camera

Data Sources

This section presents an overview of the data sources used in this project, highlighting their significance and the methodologies employed for data collection.

Table 3-3. Data Requirements

DATA SOURCE	DESCRIPTION	COLLECTION METHOD
Student Information	Includes names, student IDs, courses, and year levels.	Extracted from university records and enrollment databases.
Candidate Profiles	Information about each candidate, including name, position running for, and campaign platforms.	Collected through candidate submissions and validated by SASO Committee.
User Interviews	Insights on user needs, preferences, and feedback for system improvement.	Conducted through structured interviews and survey questionnaires.

Systems Environment

Locale

The selected study site was at Salazar St, Downtown, Tacloban City, Leyte, a college university. The Student Affairs and Services Office (SASO).

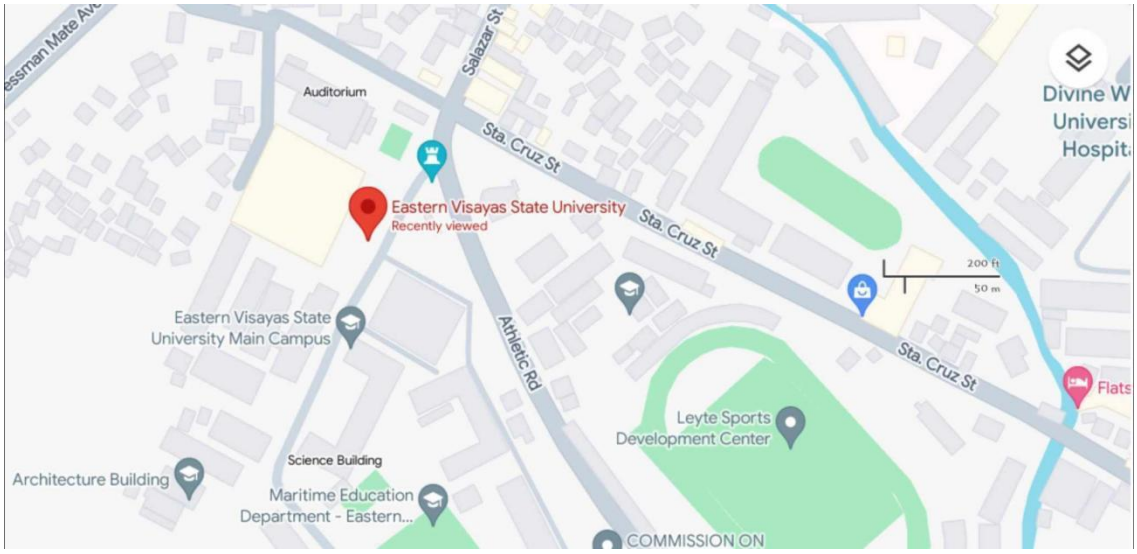


Figure 3-1. Locale of the Study

The locale of the project was at Salazar St, Downtown, Tacloban City, Leyte, a college university. The Student Affairs and Services Office (SASO) was interviewed to examine the issues of the elections and to acquire more information for the development of the project.

Population of the Study

The population of the study consists of all students, candidates, and members of the Student Affairs and Services Office (SASO) involved in the electoral process at Eastern Visayas State University. This includes all enrolled students who are eligible to vote in the student council elections, and who interact with the Smart Ballot System by entering their personal information, generating a unique QR code, and casting their votes. The population also includes the candidates running for student council positions, who are registered in the election system and have access to the candidate webpage to provide election-related information. Additionally, the study considers the SASO

committee members who oversee and monitor the election process, ensuring the integrity of the voting system and the transparency of the results. The aim of the study is to evaluate the effectiveness, efficiency, and security of the Smart Ballot System in enhancing the electoral process and ensuring a fair and transparent election.

Description of the Present System

The current election process at Eastern Visayas State University involves several manual steps. Students present their IDs to election officials, who then verify their eligibility to vote. Once verified, students receive paper ballots to mark their choices. After voting, students drop their marked ballots into a ballot box. Election officials are responsible for manually counting the ballots and checking for any discrepancies before announcing the results. This process requires substantial administrative effort and resources, often resulting in delays and potential inaccuracies.

Limitations/Drawbacks of the Present System

The existing manual election system has several significant limitations and drawbacks. Firstly, the manual verification and counting processes are time-consuming and labor-intensive, leading to inefficiencies and delays in vote tallying and result announcements. Secondly, the lack of automated verification and counting introduces a high potential for human error, which can compromise the accuracy and integrity of the election results. Additionally, the manual handling of ballots and verification processes lacks transparency and security measures, making the system vulnerable to fraud and tampering. These issues highlight the need for a more efficient, secure, and transparent election system.

Methods

This study adopted a descriptive and developmental research design to guide the development and evaluation of the Smart Ballot Voting and Management System for Eastern Visayas State University (EVSU). The descriptive aspect focused on assessing the current voting process, user behavior, and system needs. Data was collected through live demonstrations and observations involving selected student representatives to evaluate usability, accessibility, and system responsiveness.

The Agile methodology was utilized to ensure iterative progress and continuous improvement. This allowed gradual implementation of key features such as student registration, email verification codes, QR code scanning via ESP32-CAM, and live vote tallying. Feedback from demonstrations enabled timely refinements to improve performance (Holvitie et al., 2021). Agile practices have also been proven effective in similar e-voting and governance systems (Marzalia, 2023), supporting the project's goals for transparency, security, and user-centered design.

Figure 3-2. Agile Model

Requirements

In the initial phase of development, the proponents focused on gathering the necessary requirements to ensure the system addressed the core needs of its users. Key stakeholders—including the Head of Student Affairs and representatives from the EVSU Supreme Student Government—were consulted through interviews and informal discussions. These engagements revealed the need for a reliable and efficient voting system that could eliminate manual vote counting, which was time-consuming and prone to errors.

The stakeholders emphasized the importance of automating the vote tallying process and integrating a secure, user-friendly digital voting form. Based on these inputs, the system's functional requirements were defined, including user registration, email verification, QR code generation, digital ballot access, and automated vote counting. Non-functional requirements such as data security, ease of use, and system responsiveness were also identified to ensure smooth operation under real-world conditions. These documented requirements became the foundation for the system's design and development phases.

Design

Following the requirements phase, the design stage focused on structuring the overall architecture and core components of the Smart Ballot Voting and Management System. The proponents developed system diagrams, including data flow diagrams and process flowcharts, to visualize how user interactions, verification processes, and vote submissions would flow through the system. User interface prototypes were crafted with an emphasis on clarity and accessibility to ensure a smooth experience for student voters, election administrators, and coordinators. The system layout was organized to guide users through key functions—registration, verification, voting, and result monitoring—while minimizing technical complexity. A relational database schema was designed to manage user data, QR code mapping, and vote records securely and efficiently. System

components were structured to support real-time operations, ensuring performance under simultaneous access. Design elements were reviewed and adjusted based on feedback from initial consultations with stakeholders to better align with usability and functional expectations before advancing to implementation.

Database Schema. The database schema was designed to support the core operations of the Smart Ballot Voting and Management System developed for Eastern Visayas State University. It provided a structured foundation for managing users, organizing election-related data, and aligning system functionalities with academic structures.

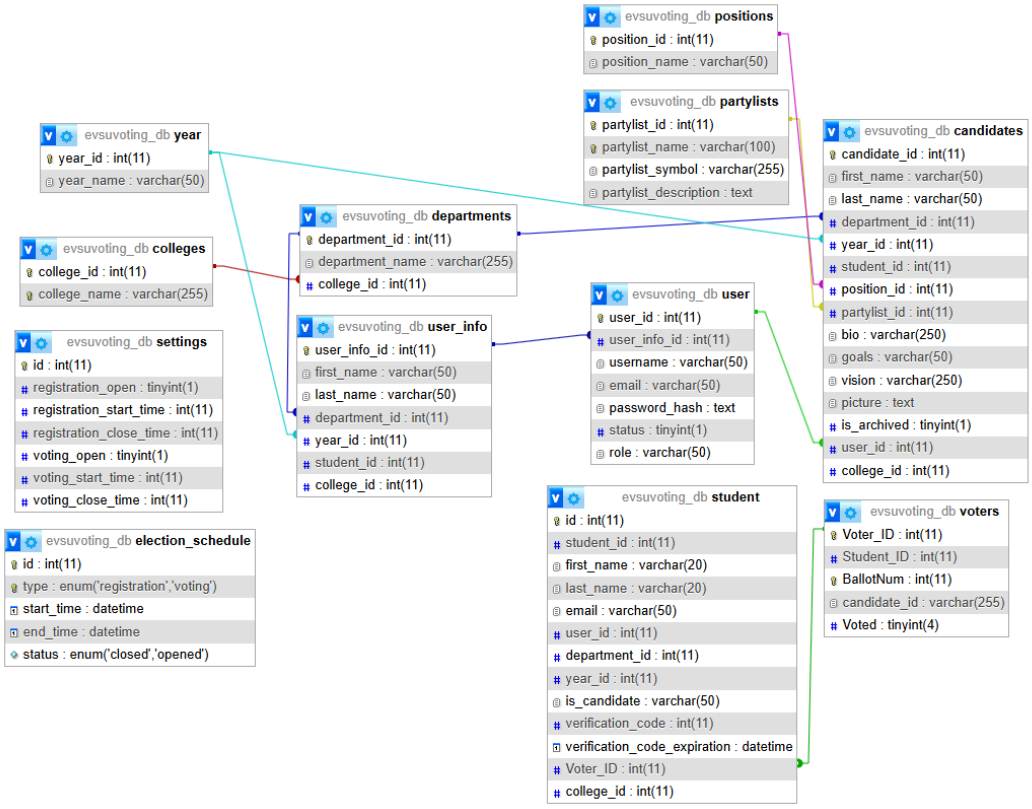


Figure 3-3. Database Schema

Figure 3-3 shows the database schema developed for the Smart Ballot Voting and Management System of Eastern Visayas State University. The schema was designed to organize and manage key information needed for the election process, including user accounts, student

details, and voter records. It also stores data related to candidates, party lists, and positions being contested in the election. To help manage the election flow, the schema includes tables for setting important dates, registration periods, and system configurations. It also includes verification features to help ensure that only eligible voters can access the system during the voting period. Academic units such as colleges, departments, and year levels are also part of the structure, which makes the system suitable for use across different parts of the university. Overall, the database supports essential functions like ballot creation, vote counting, and user management. It was built to help election administrators carry out their tasks more efficiently, while also ensuring a secure and fair voting experience for students.

Development

In the development phase, the proponents implemented the Smart Ballot Voting and Management System based on the finalized design. The system was developed using PythonAnywhere as the hosting platform, with back-end scripts and web interfaces coded to support features such as student registration, email verification, QR code generation, and automated vote tallying. Mailjet was integrated for managing email services, including verification codes and vote confirmation messages. Cloudflare was used to enhance system security and improve performance. Front-end and back-end components were developed in parallel and continuously tested to ensure smooth integration and functionality.

Testing

The testing phase aimed to validate the essential functions of the Smart Ballot Voting and Management System and ensure it operated without defects. System testing was conducted to verify critical features such as student registration, email verification using unique codes, QR code generation and scanning, and live vote tallying, confirming that each function performed as intended. Unit testing focused on individual modules, while integration testing ensured seamless

communication between the web application, backend database, and hardware components, including the ESP32-CAM and HC-SR04 ultrasonic sensor. Additional tests evaluated the hardware interaction, with the ultrasonic sensor adjusting the scanning distance for improved QR code detection. QR codes sent via email through Mailjet were tested on smartphones to confirm successful access to voting forms and secure vote submission. Internet connectivity and performance tests were also performed to verify consistent system availability, prompt email delivery, and accurate real-time vote updates during simulated elections. User acceptance testing involved selected participants to assess system usability and effectiveness. Any issues identified throughout testing were promptly addressed, leading to enhancements that improved the system's security, responsiveness, and overall user experience.

Deployment

During deployment, the Smart Ballot Voting and Management System was installed and configured at Eastern Visayas State University. Final checks ensured smooth operation in the live environment. A live demonstration was conducted for a select group of students, including Supreme Student Government officials, to familiarize them with key system features such as registration, email verification, QR code scanning, and vote tallying. A thorough user manual was provided to guide users through the system's functionalities. The system was closely monitored to maintain stability and promptly address any concerns.

Review

Following deployment, a review phase was conducted to collect feedback from the select student group, including the Supreme Student Government officials. Their input provided valuable insights on the system's strengths and areas needing improvement. Updates were made as necessary to improve system functionality and security. Documentation was updated accordingly,

and regular evaluations were planned to maintain system effectiveness and guide future enhancements.

Gantt Chart

This Gantt chart presents a clear visual timeline of the key activities involved in developing the Smart Ballot Voting and Management System. It outlines each phase from requirements gathering and design, through development and testing, to deployment and review. The chart helped ensure a systematic and organized approach to building a secure, reliable, and efficient digital voting platform that supports real-time vote tallying, user verification, and streamlined election management.

Table 3-4. Gantt Chart

ACTIVITIES	2024																							
	July				August				September				October				November				December			
Requirements ● Gather initial requirements. ● Analyze and finalize requirements.																								
Design ● Create initial design (architecture, UI/UX). ● Refine and finalize design.																								
Development ● Begin Arduino development. ● Start backend development.																								
Testing ● Evaluation																								
Deployment																								
Review																								

The Gantt chart illustrates the timeline and key tasks involved in the project's development process. It visually represents the various phases, including requirements, design, development, testing, and deployment, ensuring a structured approach to achieving project goals.

Data and Process Modeling

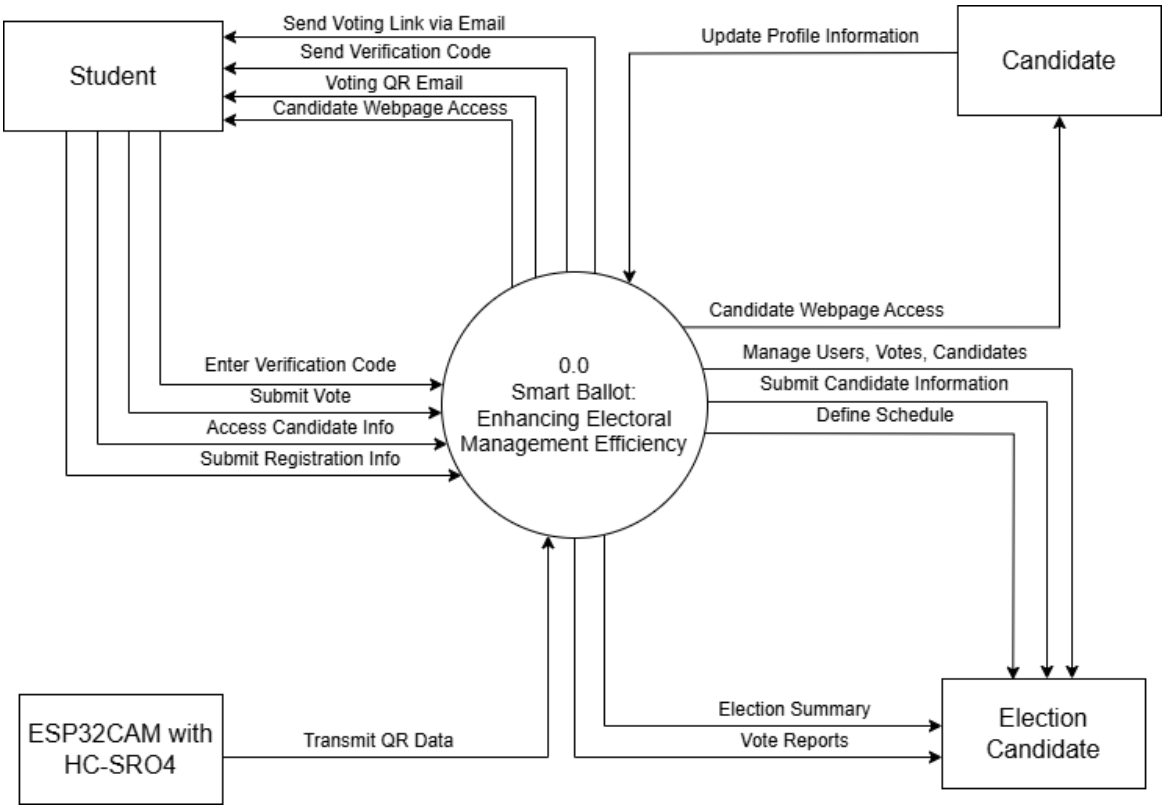


Figure 3-4. Context Diagram

The context diagram illustrates the Smart Ballot System, where students register, verify their email, and receive a unique QR code for voting. Upon scanning the QR code, students are redirected to the voting form, where they submit their vote. The system validates the QR code and the submission, and if valid, the vote is automatically counted. If there is any issue with the QR code or submission, the student is prompted to retry. The process is overseen and managed by the Election Committee and Admin.

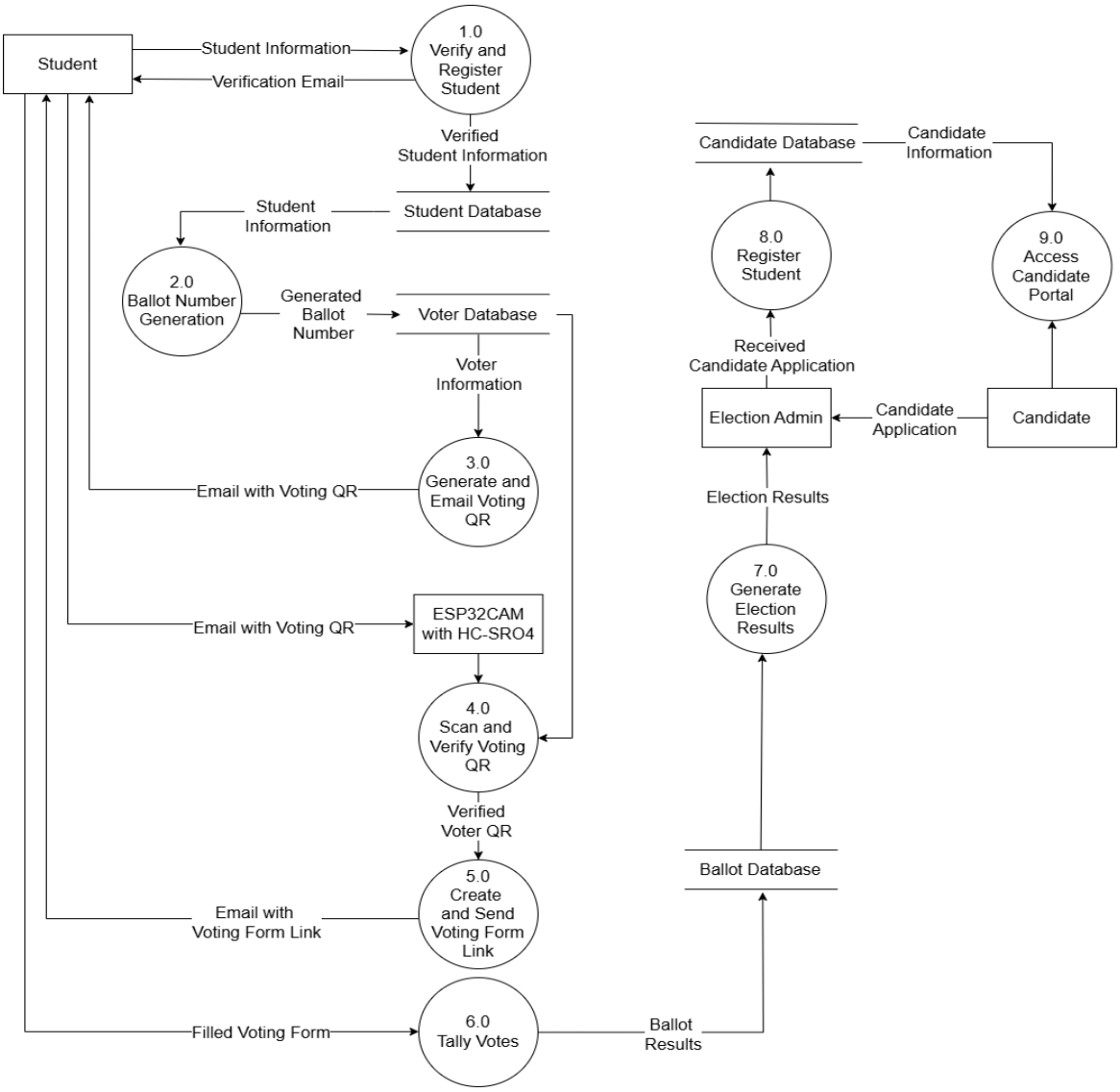


Figure 3-5. Data Flow Diagram

The Data Flow Diagram shows how students use the Smart Ballot System during elections. After online registration, students receive a verification code and a unique QR code. On election day, the QR code is scanned using the ESP32-CAM device, triggering the system to send the voting form link. Votes are submitted online and automatically tallied. Candidates submit their details to the Election Admin and access their portal to monitor status. The SASO oversees the entire process to ensure election integrity.

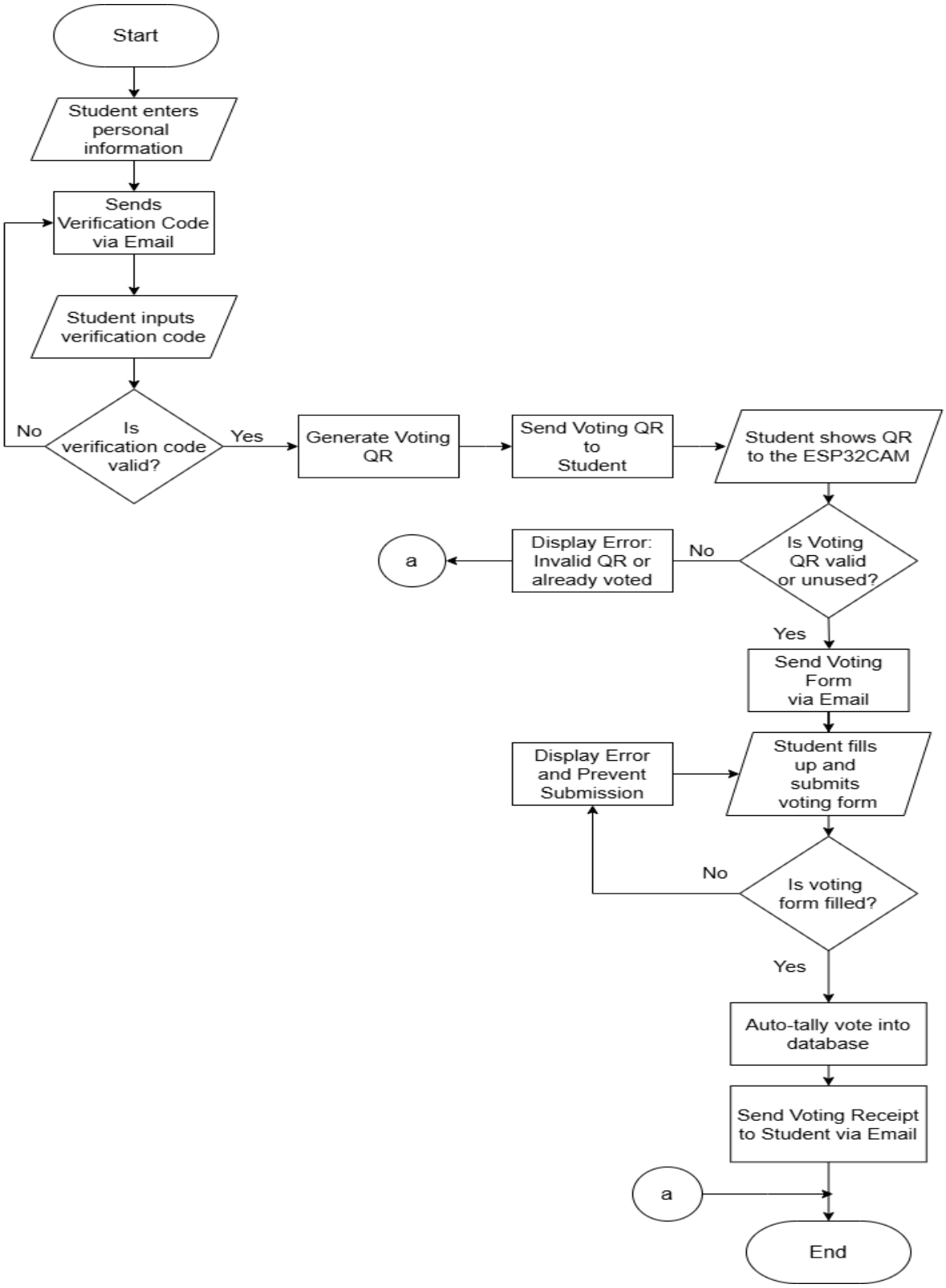


Figure 3-6. System Flowchart

The System Flowchart for the Smart Ballot System begins with student registration, where personal information is entered. A verification email is sent to the student to confirm their details. Once verified, a unique QR code is generated and sent to the student. The student scans the QR code, which redirects them to the Voting Form. After completing the form, the vote is automatically tallied and securely stored. The SASO Committee ensures the process is secure, accurate, and free of discrepancies.

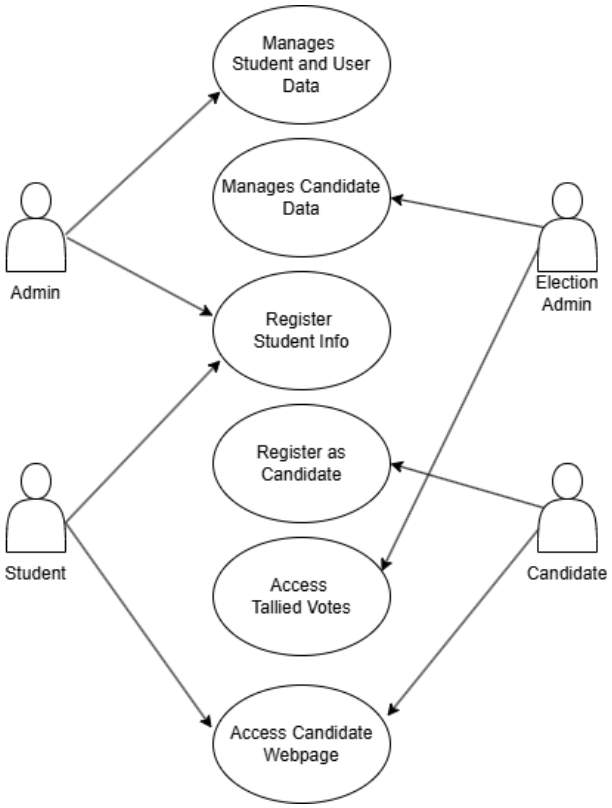


Figure 3-7. Use Case Diagram

This use case diagram explains how users, administrators, SASO Committee, and candidates interact with the smart ballot system, focusing on important tasks such as student ID registration, casting votes, accessing candidate information, and viewing counted votes. It visually outlines the roles and actions available to each type of actor within the system.

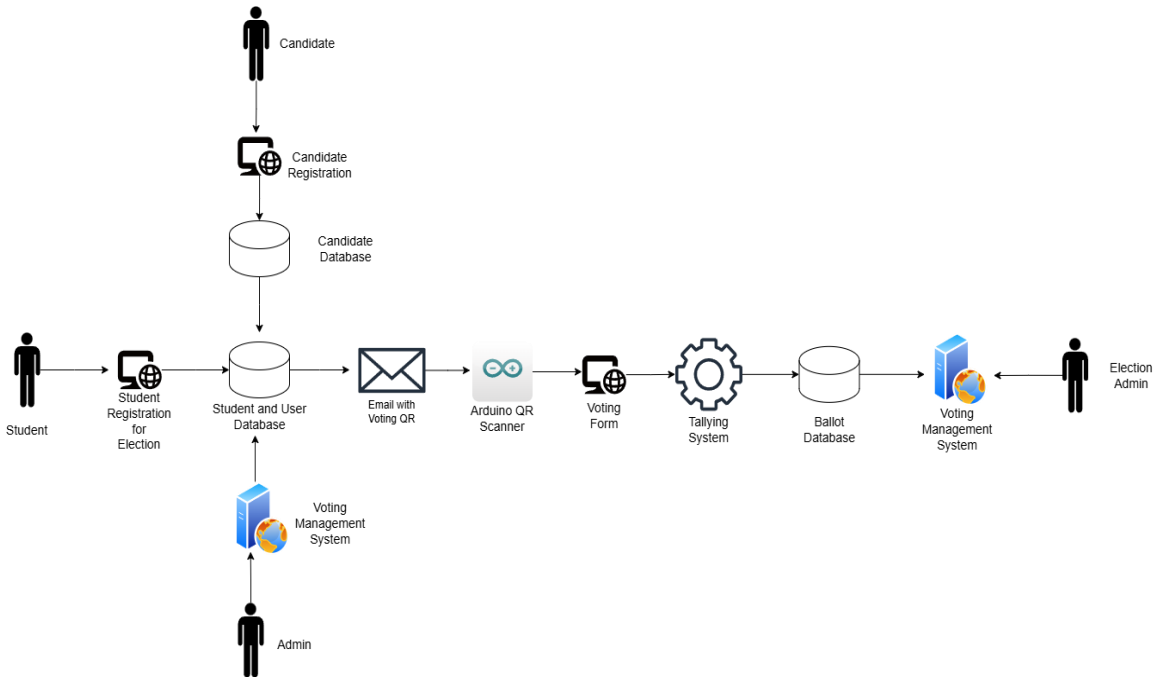


Figure 3-8. System Architecture

The system architecture illustrates the Smart Ballot System for the Student Affairs and Services Office (SASO) during elections at Eastern Visayas State University. The architecture includes key components such as student interaction with the system through entering personal information to generate a unique QR code, candidate registration for the official listing of candidates, a candidate webpage for accessing election-related information, and a web-based voting system that manages the scanning and validation of QR-coded ballots. The SASO dashboard allows for the monitoring of election results. These components work in unison to ensure the efficiency, transparency, and integrity of the electoral process, with the QR code-based system enhancing the accuracy and security of ballot distribution and vote tallying.

Chapter IV

RESULTS AND DISCUSSION

This chapter shows the results of the study's objectives and how implementing the Smart Ballot System has significantly improved the voter registration process, enhanced verification security, and streamlined on-site voting through QR code scanning and automated vote tallying within the university setting.

A comprehensive system for voter registration and management, ensuring that the electoral process is streamlined and accessible.

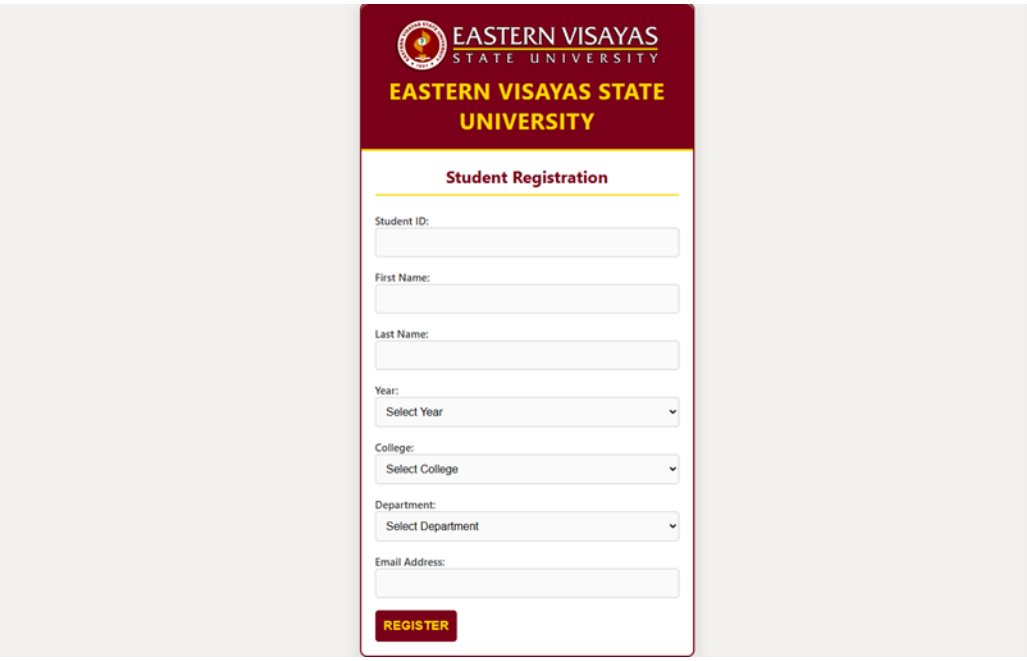


Figure 4-1. Student Registration Page

Initial registration is conducted through a dedicated form (Figure 4-1), where students input personal and institutional data. The SASO coordinator monitors submissions, ensuring that all data

are valid and complete before the system advances to verification. The structure of this page is designed to minimize friction and support bulk registration during peak periods.

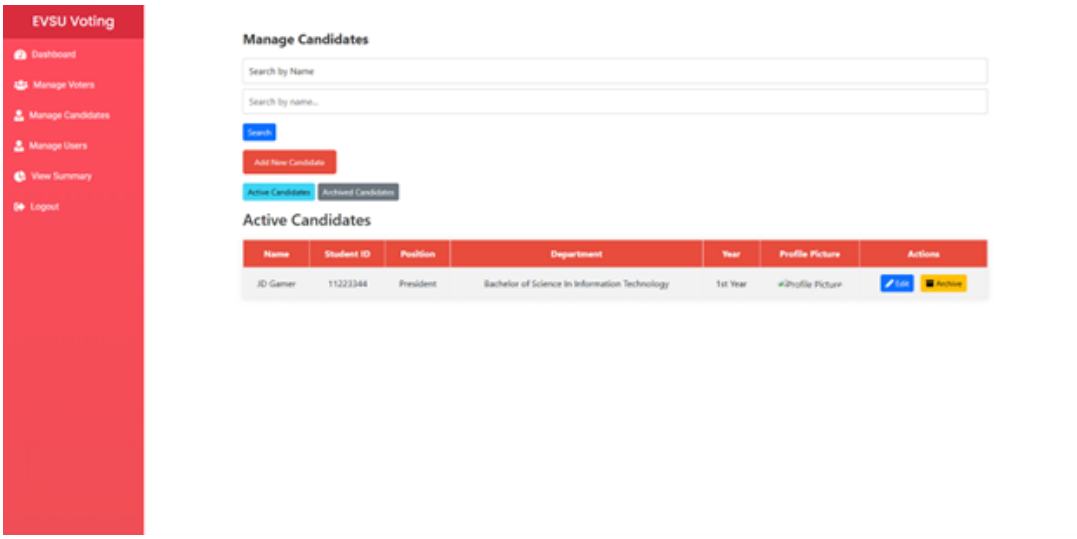


Figure 4-2. Manage Candidates Page

Candidate profiles are handled via an interface (Figure 4-2) that includes search and sort tools for large candidate pools. Unlike basic listing features, this module ensures that information remains up to date even under tight election timelines, supporting transparent campaign visibility and accurate ballot composition.

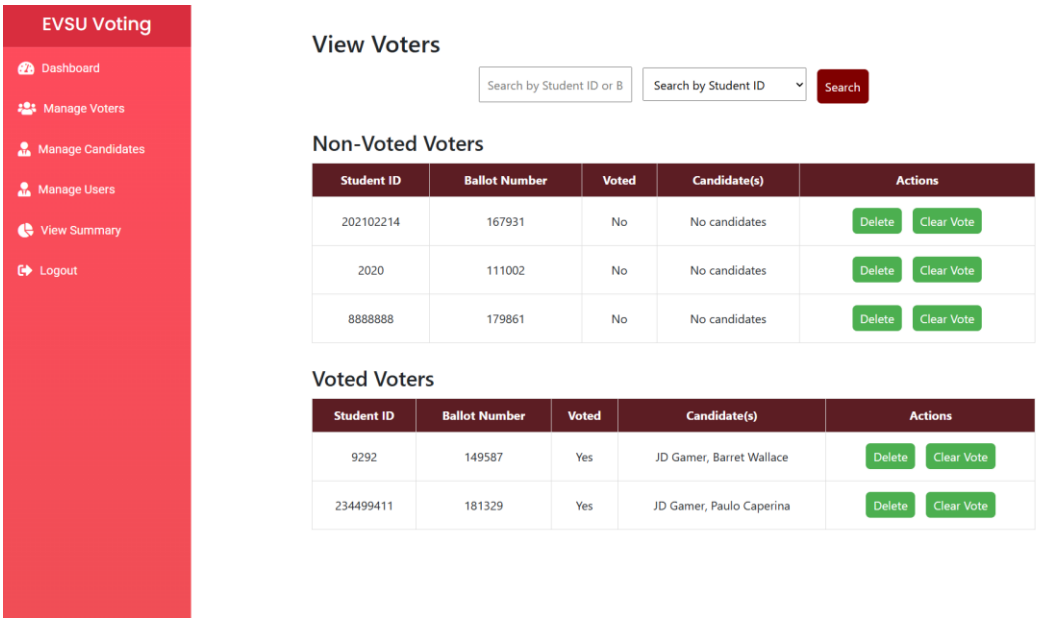


Figure 4-3. View Voters Page

A dynamic list of registrants is maintained in the View Voters section. Here, administrators can view and manage voter statuses post-verification. The ability to reset votes or update profiles allowed for quick responses to last-minute adjustments or administrative decisions during mock election simulations.

To verify voter eligibility, our system will utilize a unique voting QR code.

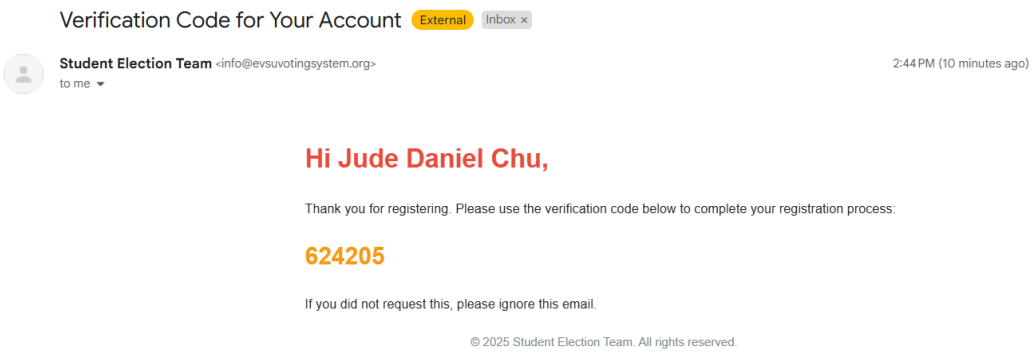


Figure 4-4. Email with Verification Code

The system dispatches a **verification code** to each registrant via email following the initial registration.

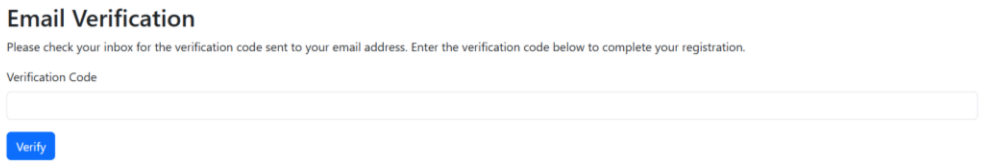


Figure 4-5. Email Verification Page

Students must enter this code on the dedicated Verification Page to confirm their identity. This step ensures only legitimate, institution-affiliated individuals proceed to the voting phase. Once verified, users are officially tagged as registered in the database.

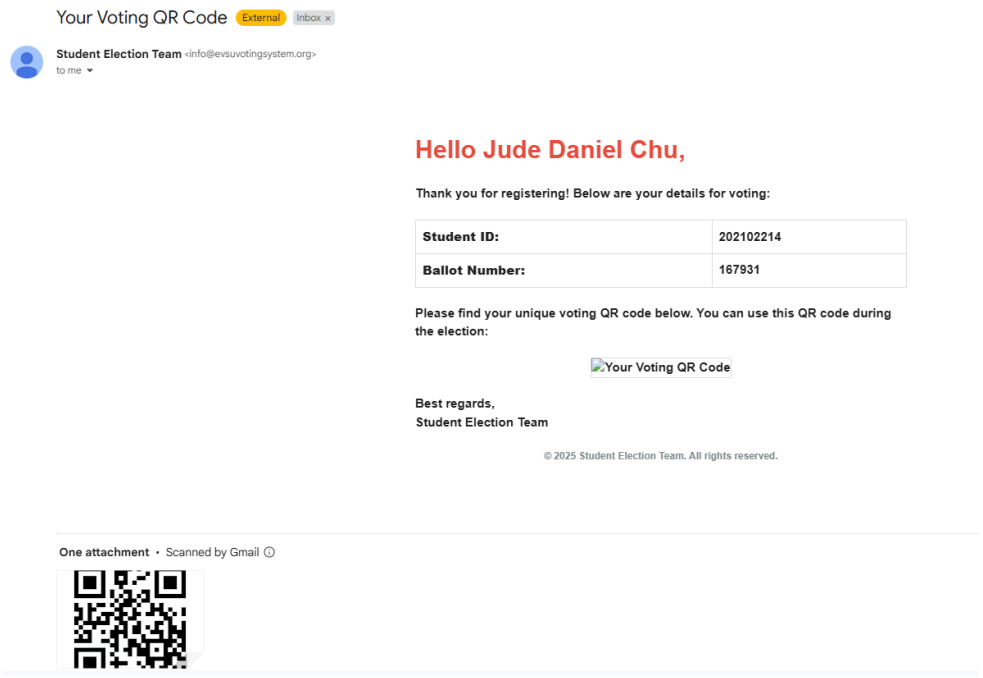


Figure 4-6. Email with Voting QR Code

Upon successful code verification, the system sends a **second email containing the unique QR code**, as shown in Figure 4-6. This QR code serves as the student's voting credential for on-site elections. Codes are uniquely linked to accounts and are rendered invalid if reused. This two-stage verification and QR issuance process ensures that only fully authenticated voters reach the ballot interface.

To develop a system that scans a QR code for on-site voting, directing users to an online ballot with automatic, accurate tallying.

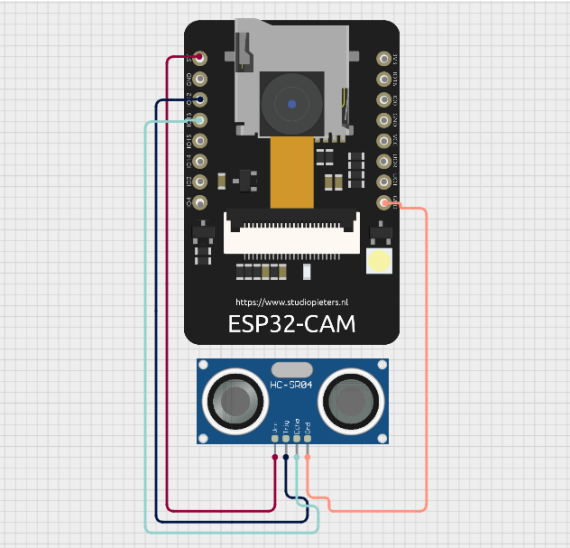


Figure 4-7. ESP32CAM with HC-SR04 Ultrasonic Sensor

Voting access is enabled through QR scanning using an ESP32CAM device (Figure 4-7). Students present their QR codes on-site, which the camera module authenticates by matching it to database records. This hardware-based access check reduced the possibility of remote or fraudulent voting. Testing revealed fast, reliable performance in offline campus settings.

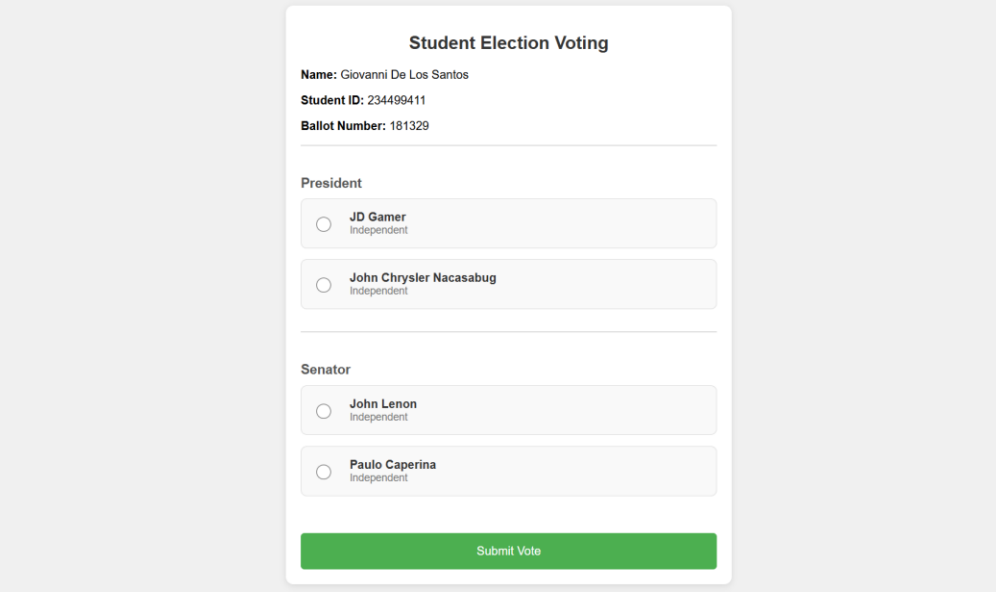


Figure 4-8. Voting Form

Once scanned and authenticated, students access the digital ballot (Figure 4-8). The interface is clean, with safeguards to ensure single submissions. Each vote is encrypted and time-stamped on submission. While the figure illustrates a standard interface, its backend complexity ensures both data privacy and traceability without revealing vote origin.

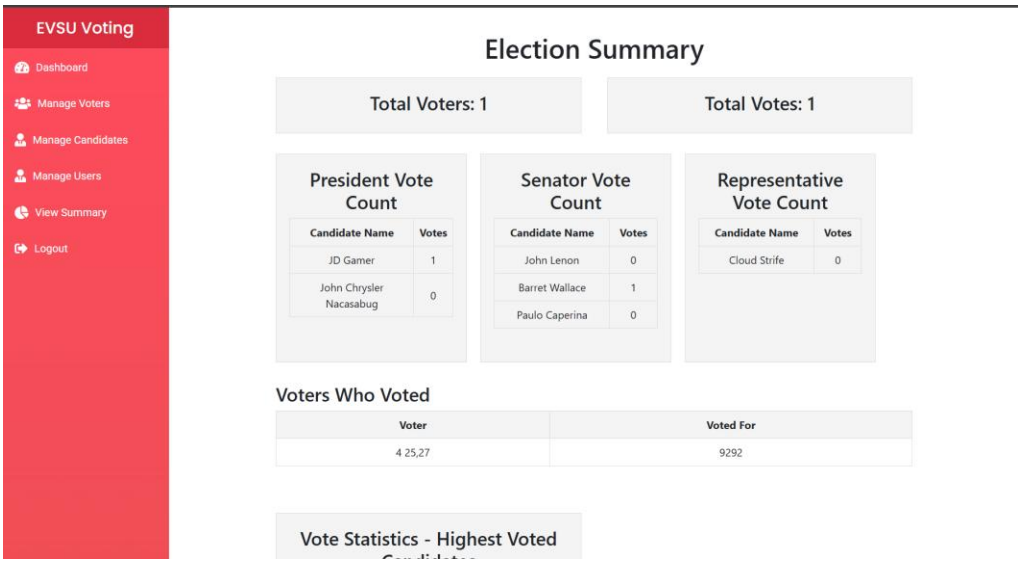


Figure 4-9. Election Summary Page

Automated vote counting is reflected in the Election Results interface (Figure 4-9), where totals are updated in time as ballots are cast. This automation eliminates manual tabulation delays and increases transparency. During system testing, the dashboard was accurate within milliseconds of submission, offering administrators immediate oversight.

Chapter V

SUMMARY, CONCLUSION, AND RECOMMENDATION

This chapter summarizes the findings from the Smart Ballot System's implementation, presents conclusions based on these results, and offers recommendations for future improvements. It highlights how the system addresses voter registration, verification, and secure voting.

Summary

The Smart Ballot System was developed to modernize university elections by streamlining voter registration, implementing secure email-based verification with QR code issuance, and enabling on-site QR scanning with automatic vote tallying. Evaluations conducted in a simulated academic environment demonstrated significant improvements in managing voter registration through real-time data tracking and enhanced administrative control. The system's email verification mechanism ensured that only eligible voters received unique QR codes, thereby upholding the integrity of the electoral process. The QR scanning functionality enabled rapid and accurate vote submissions with automated tallying, effectively minimizing human errors associated with manual counting. User acceptance testing indicated that the system is accessible and user-friendly for a diverse range of participants, including those with limited technical experience. While the system effectively handled multiple concurrent users, minor performance degradation was noted during peak activity periods, highlighting opportunities for technical refinement. Overall, the Smart Ballot System successfully fulfilled its core objectives, contributing to increased election efficiency, data security, and process transparency, thereby offering a scalable and practical solution for academic electoral settings.

Conclusion

The Smart Ballot System has effectively modernized student elections by addressing inefficiencies, enhancing security, and reducing administrative workload. Through the integration of online registration, Arduino-based QR validation, and real-time result tracking, the system promotes transparency, accuracy, and streamlined operations throughout the voting process.

1. Student Registration and Verification. Students register through a secure online platform and verify their identity using a system-generated code sent via email. Once verified, a unique QR code containing their student ID and ballot number is created and stored in both the student and voter databases. This dual verification process ensures only eligible and authenticated students can vote, reducing the risk of fraud or duplicate entries.

2. QR-Based Ballot Validation via ESP32-CAM. During on-site voting, students present their QR code to an ESP32-CAM device, which decodes it and sends a secure voting form link to the student's email. This automated process eliminates manual checking, ensuring that only pre-verified individuals access the ballot. The use of Arduino hardware enables a scalable, portable solution that accelerates ballot validation and increases voting efficiency.

3. Automatic Tallying and Real-Time Monitoring. Votes submitted through the form are recorded instantly in the database. The system performs automatic tallying and updates candidate totals in real-time, which election admins can view through a live dashboard. This reduces human error, speeds up result generation, and ensures transparency with digital logs of all voting actions.

In summary, the Smart Ballot System enhances election integrity, boosts student engagement, and simplifies management through a well-integrated combination of digital platforms and hardware. It provides a secure and scalable foundation for efficient student government elections and can be adapted to broader institutional needs.

Recommendation

To further enhance the Smart Ballot System and ensure its effective deployment in future elections, the following recommendations are proposed:

1. **Improve QR Code Detection:** Optimize the ESP32-CAM's scanning capabilities through better camera calibration and adaptive image processing to ensure accurate QR code recognition in various lighting conditions.
2. **Add Visual Feedback:** Incorporate LED indicators or on-screen notifications to immediately inform voters when their QR code has been successfully scanned, enhancing user confidence and experience.
3. **Enhance User Interface:** Redesign key pages with a more user-friendly layout to simplify navigation and make the system accessible to users with varying levels of technical proficiency.

REFERENCES

Al-jawaherry, M. A. (2019). Arduino–Based Electronic Voting Machine. Tikrit Journal of Pure Science, 23(10), 102–109. https://doi.org/10.25130/tjps.v23i10.572

Al-Rahmi, W. M., & Othman, M. S. (2013). The impact of social media use on academic performance among university students: A pilot study. *Journal of Information Systems Research and Innovation*, 4, 1–10.

Al-Rahmi, W. M., Alzahrani, A. I., Yahaya, N., Alalwan, N., & Kamin, Y. B. (2020). Digital communication: ICT usage for education sustainability. Sustainability, 12(12), 5052. https://doi.org/10.3390/su12125052

Alvarez, R. M., Hall, T. E., & Llewellyn, M. (2009). Are electronic voting systems secure? *Journal of Politics*, 71(3), 1043–1058. https://doi.org/10.1017/S0022381609090932

Chaum, D., Ryan, P., & Schneider, S. (2008). A practical voter-verifiable election scheme. *Proceedings of the Workshop on Privacy in the Electronic Society*, 118–129. https://doi.org/10.1145/1408664.1408682

Circuit Digest. (2022). *ESP32-CAM Based QR Code Scanner*. Retrieved from https://circuitdigest.com/microcontroller-projects/esp32-cam-qr-code-scanner

De Leon, J. E. (2019). Digital transformation and electoral reforms in the Philippines. *Philippine Political Science Journal*, 40(2), 115-131. https://doi.org/10.1080/01154451.2019.1647167

Holvitie, J., Licorish, S. A., Spínola, R. O., & Mäntylä, M. V. (2021). Technical debt and agile software development practices and processes: An industry practitioner survey. *Journal of Systems and Software*, *182*, 111059.

Ikrissi, G., & Mazri, T. (2024). Electronic Voting: Review and Challenges. Innovations in Smart Cities Applications, 7, 110–119.

Iqbal, M., & Rahman, A. (2023). Encrypted Arduino-Based Voting System for Academic Elections. International Journal of Research in Engineering and Science, 11(3), 45–50.

Ismail, S. I., Kar, S. A. C., Abdullah, R., Amri, M. A. H. M., Ismail, M. Z., Nik, N. N., & Zaki, M. (2021). Electronic Voting Machine Using Infrared Detection on Arduino Platform. IOP Conference Series: Materials Science and Engineering, 1176(1), 012015. https://doi.org/10.1088/1757-899X/1176/1/012015

Kshetri, N. (2021). Blockchain and electronic voting: Recent developments and challenges. *IEEE Transactions on Engineering Management*, 68(2), 378–388. https://doi.org/10.1109/TEM.2020.2977707

Marzalia, A. Y. (2023). The challenges of implementing e-voting in elections as a new form of agile governance in Indonesia. *Prosiding University Research Colloquium*, *7*(1), 104–111.

Patil, S., Joshi, R., & Desai, K. (2021). Real-Time Vote Counting Using Arduino-Based EVM. International Journal of Computer Applications, 183(23), 15–20.

Random Nerd Tutorials. (2022). *ESP32-CAM QR Code Reader and Web Server*. Retrieved from https://randomnerdtutorials.com/esp32-cam-qr-code-reader-web-server

Roy, A., Saha, S., & Bera, D. (2022). A Smart Identity Verification System Using ESP32-CAM and QR Code. *International Journal of Engineering Research & Technology (IJERT), 11*(7), 158–162. https://doi.org/10.17577/IJERTV11IS070118

Sai, P. N. V., Avinash, S. D. N. M., Krishna, V. S., Subhani, S., & Reddy, M. M. (2023). Arduino Based Electronic Voting Machine. International Journal of Communication and Computer Technologies, 9(2), 21–26. https://ijccts.org/index.php/pub/article/view/141

Singh, S. S. (2024). Design and Development of Arduino-Based Voting System with Real-Time Feedback. International Journal of Scientific Research and Engineering Development, 7(1), 791–794. https://doi.org/10.5281/zenodo.10702316

Verma, A., Choudhary, P., & Jain, S. (2023). Smart Voting System Using Biometric and Smart Card Authentication on Arduino Platform. International Journal for Research in Applied Science and

Engineering Technology, 11(4), 123–130. https://www.ijraset.com/research-paper/arduino-based-smart-and-remote-voting-system

Voogt, J., Fisser, P., Good, J., Mishra, P., & Yadav, A. (2015). Computational thinking in compulsory education: Towards an agenda for research and practice. *Education and Information Technologies*, 20(4), 715–728. https://doi.org/10.1007/s10639-015-9412-6

APPENDIX A

Request Letter to Client

Republic of the Philippines
EASTERN VISAYAS STATE UNIVERSITY
Tacloban City
COLLEGE OF ENGINEERING

BAGONG PILIPINAS

October 30, 2024

Mr. Quitin A. Mazo III
Admin Aide I of Student Affairs Office
Eastern Visayas State University
Tacloban City

Dear Mr. Mazo,

Greetings!

As a valued stakeholder in our capstone project, the undersigned would like to formally invite you to sit in and observe during the mock defense of our Capstone 2 titled "**Smart Ballot: Enhancing Electoral Management Efficiency**" The mock defense is scheduled to take place in **November 5, 2024** at **4:00 PM – 5:00 PM.** at the Eastern Visayas State University-Main Campus Information Technology Building.

Your insights and feedback would be invaluable during this session, and we would greatly appreciate your presence as we present our developed system. Your expertise will provide a unique perspective that can help refine our final defense.

Please let us know if you are available to attend. We would be honored to have you join us and offer your feedback. Please feel free to reach out directly at **09156964580** for any questions or further details regarding the mock defense.

Thank you for considering this invitation. We look forward to your response.

Sincerely,

JUDE DANIEL CHU JOHN CHRYSLER NACASABUG VOLTAIRE ART MONGE

Approved:

JESSIE R. PARAGAS, DIT
Capstone Project 1 Adviser and Head, Information Technology Department

MR. QUITIN A. MAZO III
Admin Aide I of Student Affairs Office

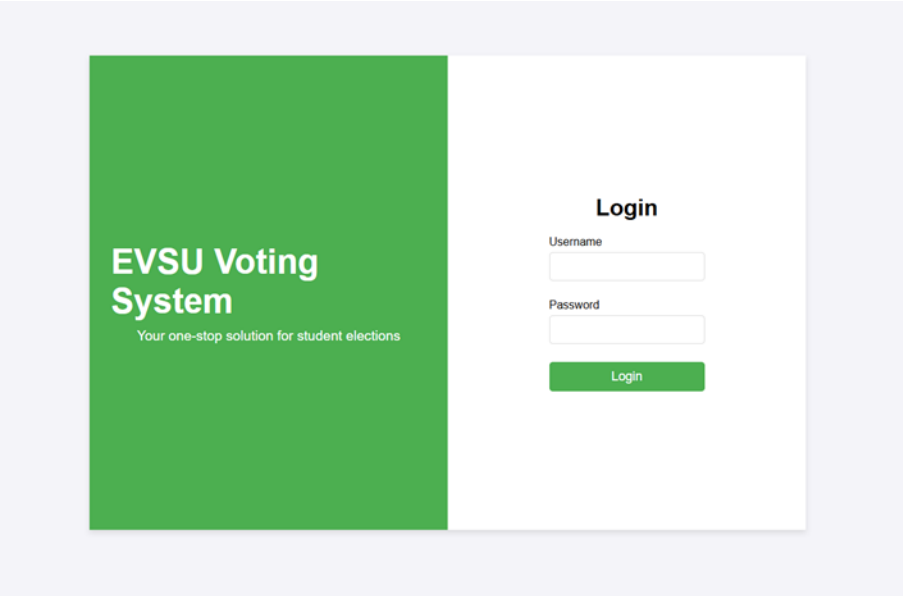
QUALITY SYSTEM CERTIFICATION DNV

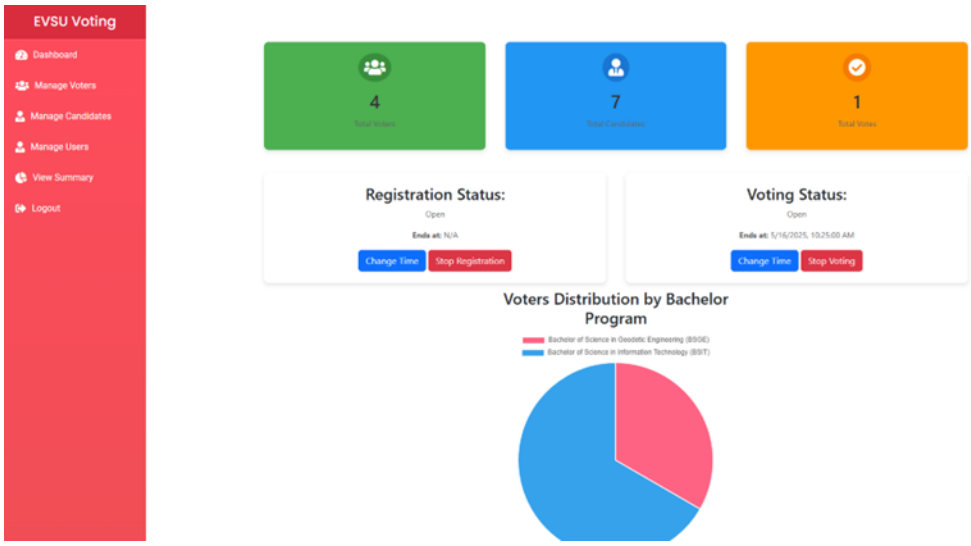
"Building Globally Competitive Professionals"

APPENDIX B

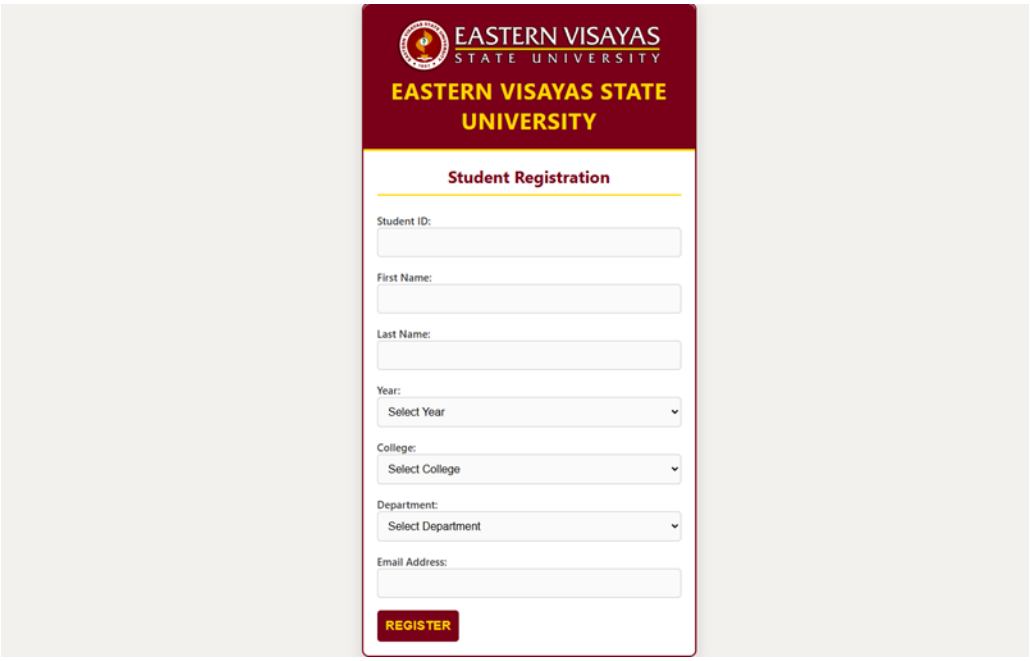
Sample Input/Output/Reports

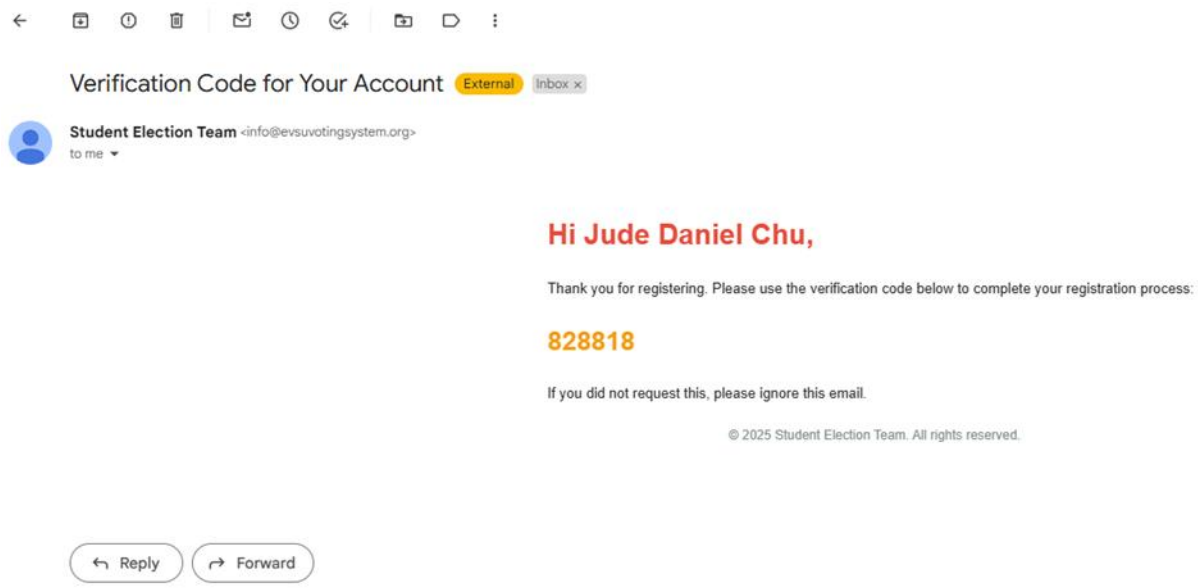
ADMIN



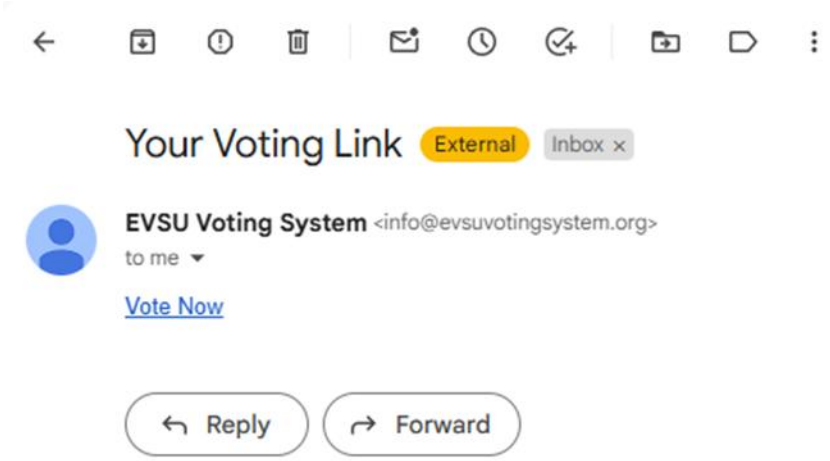


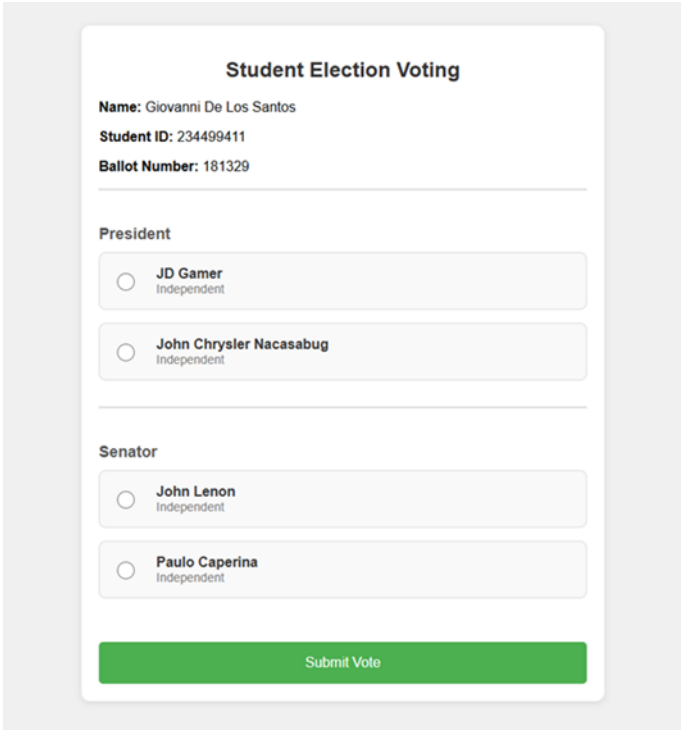
STUDENT REGISTRATION





RESULT


Your Voting Link
External
Inbox ×
EVSU Voting System <info@evsuvotingsystem.org>
to me
Vote Now
Reply
Forward


Student Election Voting
Name: Giovanni De Los Santos
Student ID: 234499411
Ballot Number: 181329
President
JD Gamer
Independent
John Chrysler Nacasabug
Independent
Senator
John Lenon
Independent
Paulo Caperina
Independent
Submit Vote

Election Summary

Total Voters: 2

Total Votes: 2

President Vote Count

Candidate Name	Votes
JD Gamer	2
John Chrysler Nacasabug	0

Senator Vote Count

Candidate Name	Votes
John Lenon	1
Barret Wallace	1
Paulo Caperina	0

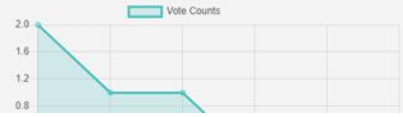
Representative Vote Count

Candidate Name	Votes
Cloud Strife	0

Voters Who Voted

Voter	Voted For
4 25,27	9292
7 25,26	234499411

Vote Statistics - Highest Voted Candidates



APPENDIX C

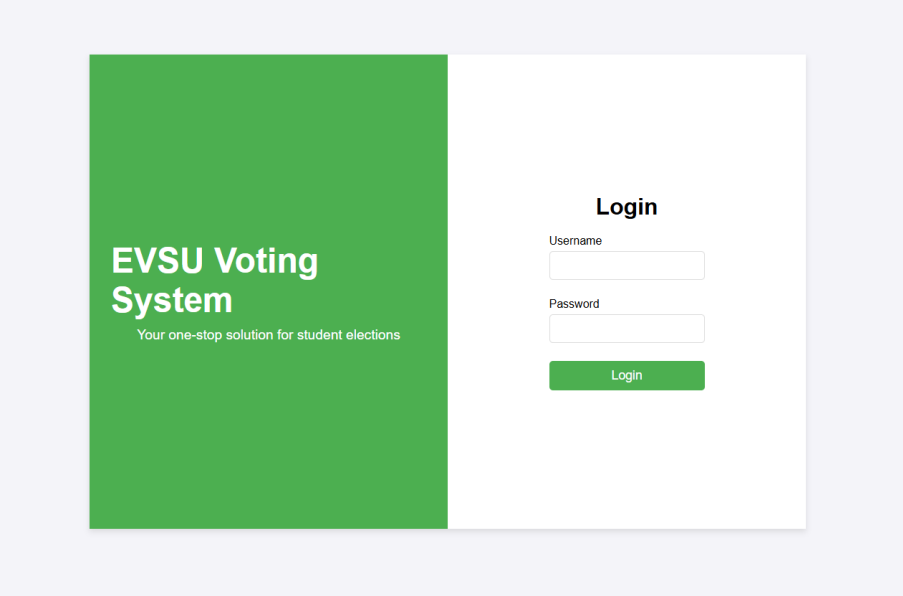
User's Guide/Manual

Step-by-Step Guide to Register, Vote, and Tally Results Using Email-Based Smart Ballots

This manual explains how to use the web-based voting system with email-based smart ballots. It includes the steps to register as a voter or candidate, cast votes via email, and automatically tally votes. The results will be displayed on the dashboard for election results.

---

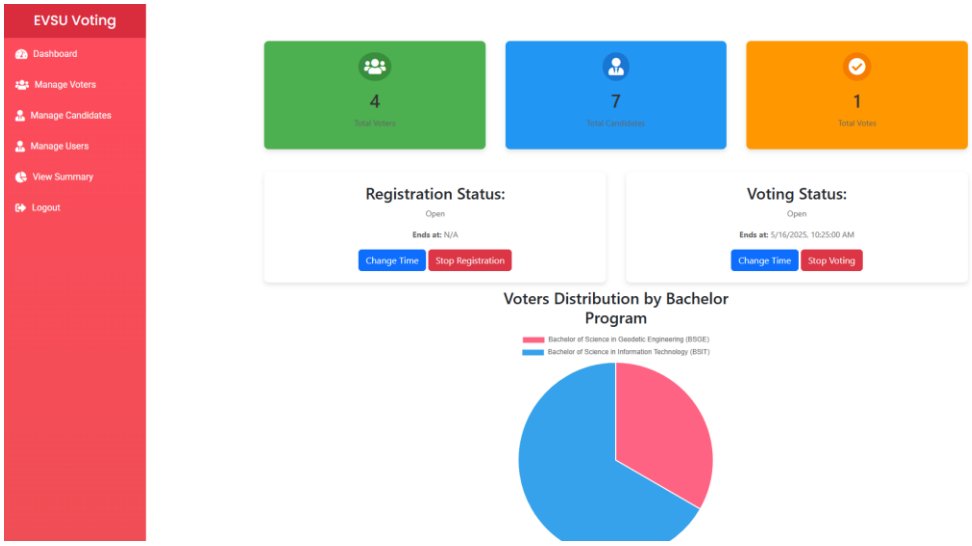
1. Logging In as an Admin



Enter Admin Credentials

- Input your admin username and password into the login fields.
- Click the Login button.

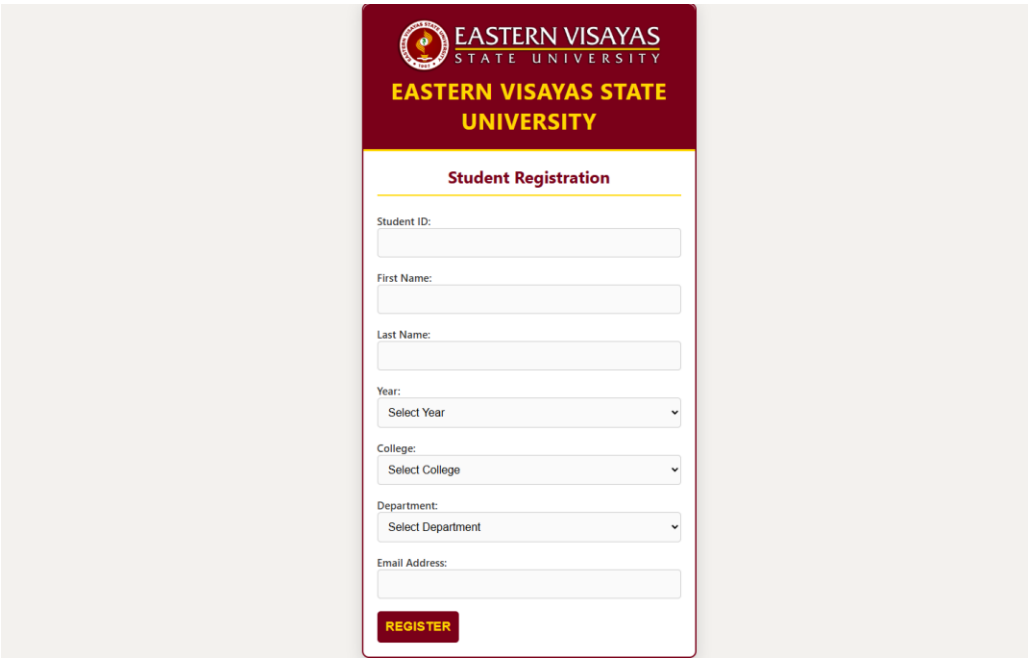
Admin Dashboard Access
Once successfully logged in, the admin will be redirected to the Admin Dashboard. From here, admins can manage voter registrations, candidate registrations, monitor the voting process, and view election results.



Logout Option
To log out, click on the Logout button.

---

2. Registering as a Student (Voter)



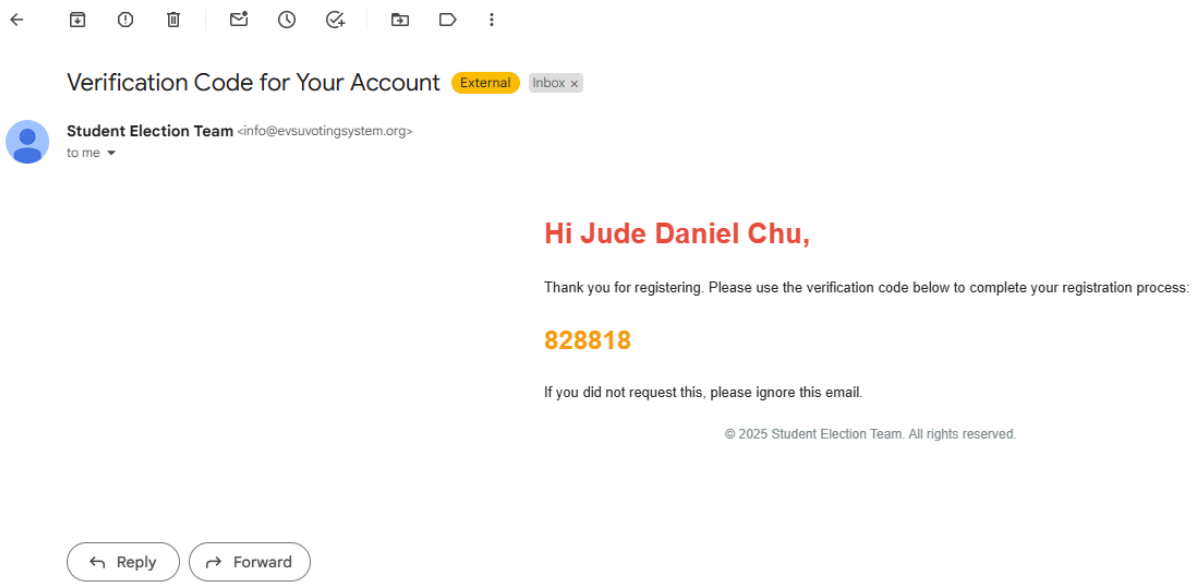
Enter Student Information
Fill in the registration form with the following details:

- First Name
- Last Name
- Student ID

- College
- Program or Department (if applicable)
- Email Address

Submit Registration
After filling in all the details, click the Register button to complete the registration.

Receive Registration Verification Email
Once the registration form is submitted, the system will automatically send a Verification Email to the student's registered email address. This email contains a Verification Code that you will input into the Verification Page.



Verification Process

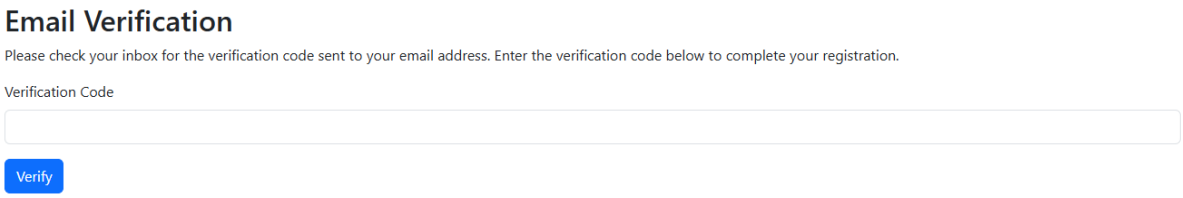
Receive Verification Email

- After submitting the registration form, the student will receive a **Verification Email** at their registered email address.
- This email will contain a **Verification Code** (example: a 6-digit code like 548329).

Enter the Verification Code

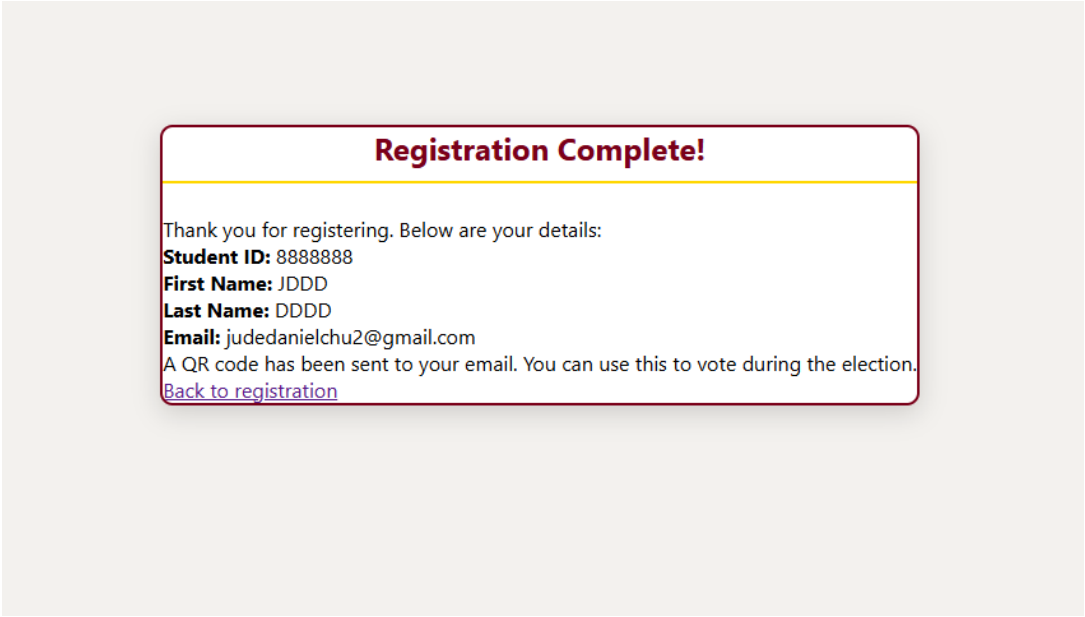
- Go back to the system's **Verification Page** (a link to this page is provided after registration or in the email).
- Input the **Verification Code** into the verification form.

- Click the **Verify** button.



Successful Verification

- If the code is correct, the system will display a message confirming that the student's registration was **successfully verified**.
- The student can now participate in the election.



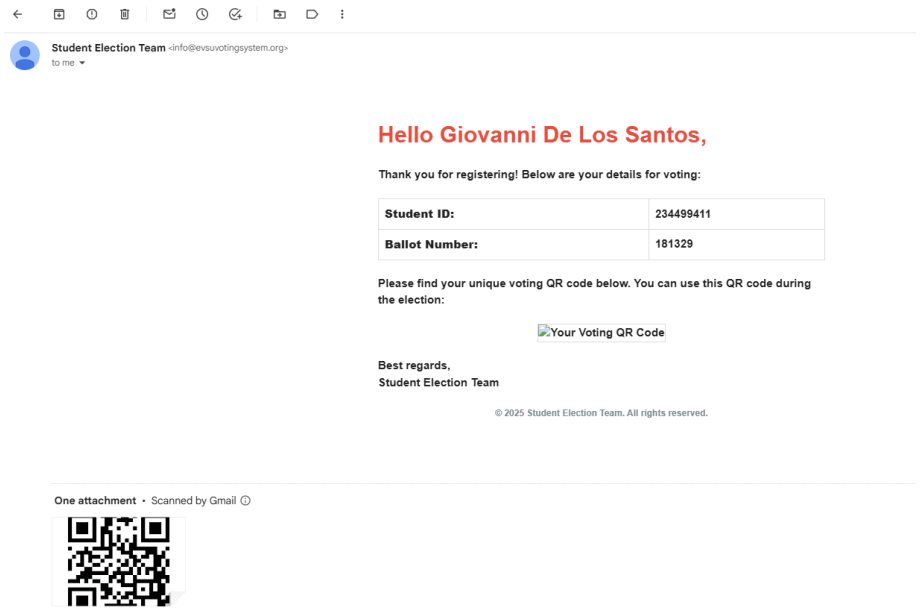
Confirmation of Registration

- Once the verification is complete, the student's status will be updated in the system.
- The student will now be fully registered and eligible to participate in the election.

QR Code Distribution After Verification

- **Receive QR Code Email**

- After successful verification, the system automatically sends another **email containing a unique QR Code**.
- This **QR Code** is tied to the student's ID and voting access.
- Students are instructed to **keep this QR Code email safe**, as it will be needed onsite for voting.



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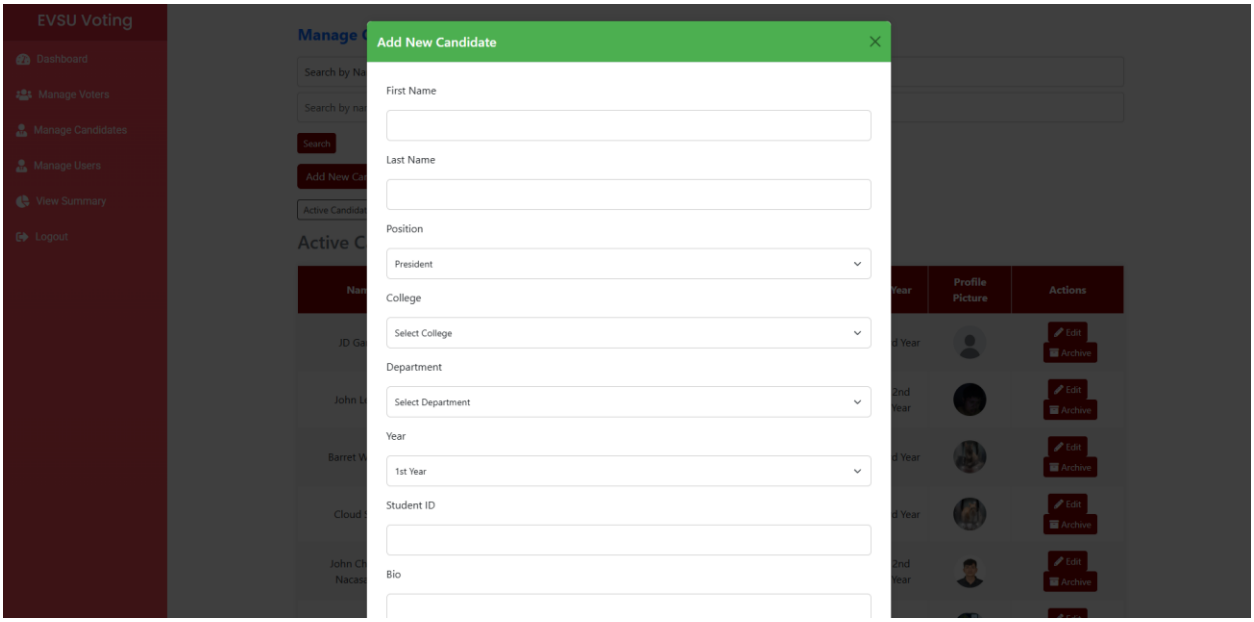
3. Registering Candidates via Admin Login

Login as Admin
After logging in as the admin, navigate to the Manage Candidate section of the dashboard.

Add Candidate
After navigating to the Manage Candidate section, select Add Candidate. A modal will pop up containing inputs for candidate info.



Enter Candidate Details
Fill out the registration form for the candidate, including:

- First Name
- Last Name
- Candidate ID (provided by the admin)
- Candidate's Bio (optional)
- Candidate's Photo (optional)
- Email
- Username
- Password

Submit Candidate Registration
After entering the candidate's details, click the Submit button to complete the registration.
A confirmation message will appear once the candidate is successfully registered.

Confirm Registration
The candidate is now listed in the system and will be visible to voters during the election process.

On-Site Voting Process Using QR Code

Go to the Voting Site

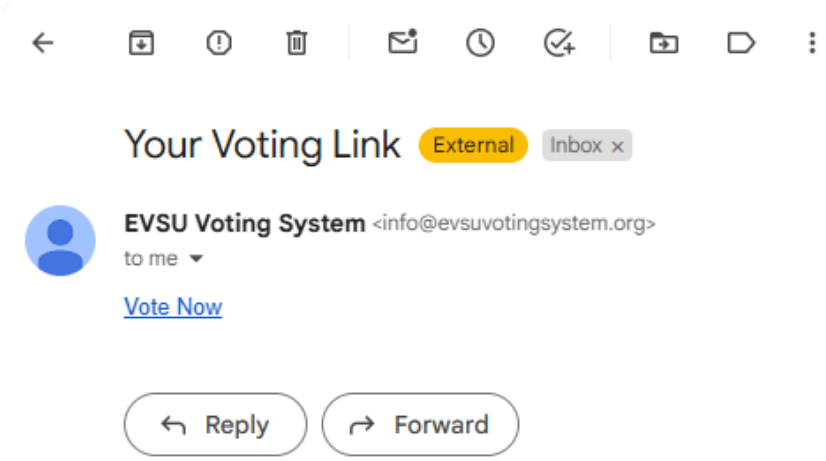
- The student proceeds to the **designated voting location** set up by the election administrators.

Scan the QR Code

- At the voting site, the student **presents the QR Code** (shown on their mobile phone or printed).
- The **Arduino QR Scanner** reads the QR Code.

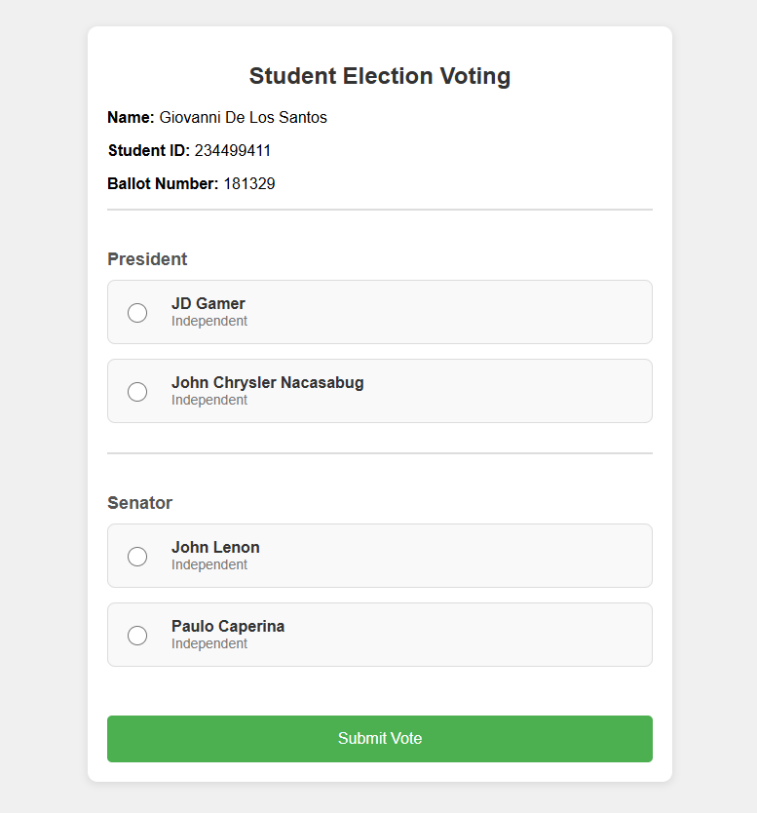
Once scanned:

- The system checks if the QR is valid and if the student has not voted yet.
- If valid, the student is allowed to access the **Voting Form** on a designated tablet, PC, or kiosk.



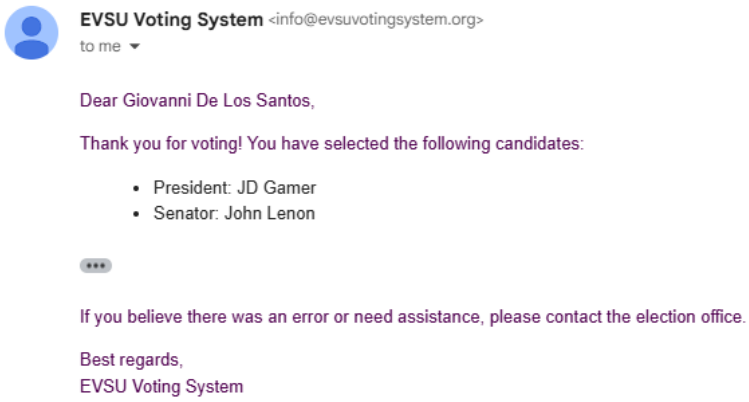
Cast Your Vote

- The student **selects their candidate** on the electronic voting form.
- After selecting, they click **Submit Vote**.



Vote Confirmation

- The system processes and saves the vote.
- A **Confirmation Message** appears on the screen.
- Optionally, a **Vote Confirmation Email** may also be sent to the student's email address.



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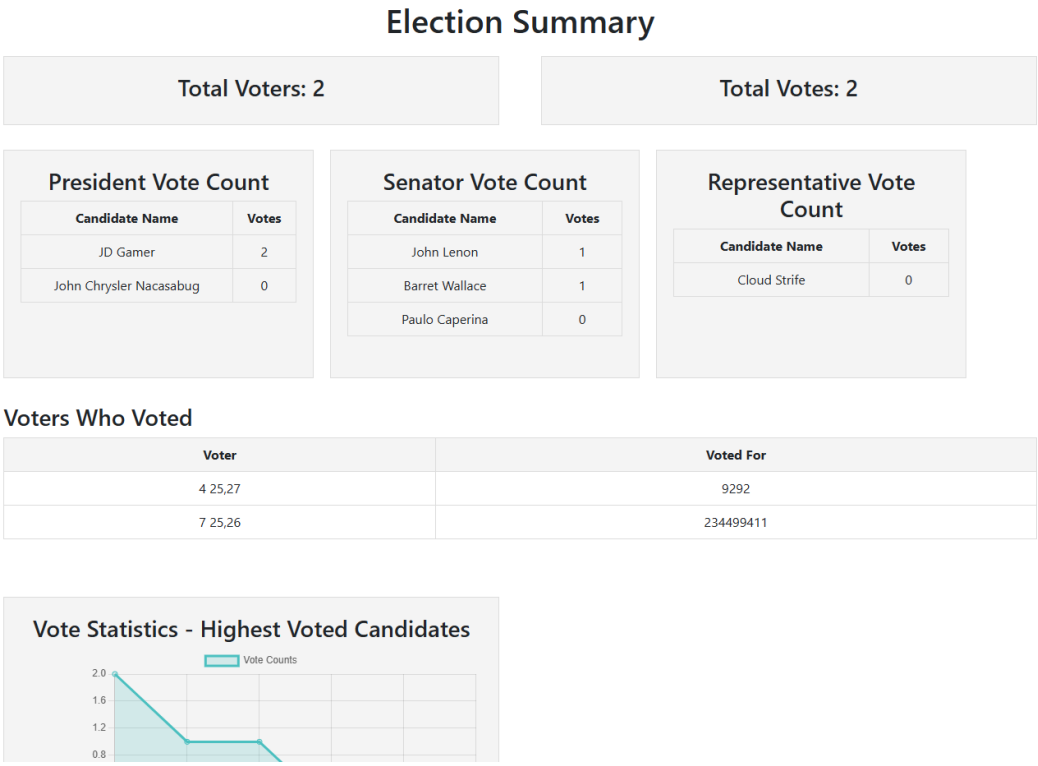
5. Ballot Tallying Process and Real-Time Updates

Vote Data Transfer
The system automatically records each vote as it is cast. No manual tallying is required.



Vote Tallying

- Each submitted vote is tallied in real-time, updating the total votes for the selected candidate.
- Results are immediately reflected in the system, eliminating the need for manual vote counting.

Results Dashboard
Election results are updated live and can be viewed through the Election Results Dashboard, which displays vote counts for each candidate. The dashboard is visible to both admins and the public (if applicable) for transparency.

---

6. Viewing Election Results

Access the Results Dashboard
After all votes are cast, the results can be viewed in the Election Results Dashboard.
The dashboard will be available to both the admin and the public (if applicable) for transparency.

Real-Time Updates
The election results are displayed in real-time, with updates as each vote is submitted and processed.

Results Summary
The dashboard will display:

- Total votes cast
- Vote count for each candidate
- Winning candidate and their vote share

---

8. Benefits of the Email-Based Voting System

- No Paper-Based Ballots: The entire voting process is managed through email, eliminating the need for paper ballots and scanning.
- Secure Voting: Each voter receives a unique Voting Link in their email, ensuring that only verified voters can cast a vote.
- Efficient and Fast: Real-time vote recording and tallying, reducing the time required for manual counting and ensuring the results are quickly available.
- Transparency: Election results are displayed on a public dashboard, allowing for full transparency throughout the election process.

APPENDIX D

Acceptance Sheet

Republic of the Philippines
EASTERN VISAYAS STATE UNIVERSITY
Tacloban City
COLLEGE OF ENGINEERING

BAGONG PILIPINAS

CERTIFICATE OF ACCEPTANCE

THIS IS TO CERTIFY that the thesis entitled, **"SMART BALLOT: ENHANCING ELECTORAL MANAGEMENT EFFICIENCY"**, a web-based system developed by Jude Daniel A. Chu, John Chrysler G. Nacasabug, 4th year BS Information Technology students, has been tested, evaluated, and examined and therefore accepted by **MR. QUINTIN A. MAZO III**

Approved by:

MR. QUINTIN A. MAZO III
Admin Aide I of Student Affairs Office

APPENDIX E

Turnitin Certificate

Republic of the Philippines
EASTERN VISAYAS STATE UNIVERSITY
Tacloban City

INFORMATION TECHNOLOGY DEPARTMENT

Certificate of Similarity Index

This is to certify that the Capstone Project entitled:

SMART BALLOT: ENHANCING ELECTORAL MANAGEMENT EFFICIENCY

authored by:

Jude Daniel A. Chu
John Chrysler G. Nacasabug

Bachelor of Science in Information Technology
has been subjected to similarity check on December 1, 2024
with a generated Similarity Index of **___%**

Certified true and correct:

JESSIE R. PARAGAS, DIT
Capstone Project Adviser

Noted:

Lyra K. Nuevas, PhD
Capstone Project Instructor

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Civil Status: Single

SKILLS

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- PHP
- CSS
- Photoshop

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- PHP
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