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An Autonomous Institution
Affiliated to Anna University Chennai, Approved by AICTE New Delhi,
ISO 9001:2015 & ISO 14001:2015 Certified Institution, Accredited with 'A+' grade by NAAC
Samayapuram, Tiruchirappalli – 621 112, Tamilnadu, India.

A Project Report

on

ONLINE VOTING SYSTEM

Submitted in partial fulfillment of requirements for the award of the course

of

EGB1201 – JAVA PROGRAMMING

Under the guidance of

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Submitted By

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY
(Autonomous)

TRICHY - 621112

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BONAFIDE CERTIFICATE

Certified that this project report on **"ONLINE VOTING SYSTEM"** is the Bonafide work of **LIBINA X(2303811710622058)**who carried out the project work during the academic year 2024 - 2025 under my supervision.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION OF THE INSTITUTION

To emerge as a leader among the top institutions in the field of technical education

MISSION OF THE INSTITUTION

- Produce smart technocrats with empirical knowledge who can surmount the global challenges
- Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students
- Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations

VISION OF THE DEPARTMENT

To create innovative and socially responsible Electronics and Communication Engineers with design skills and research focus to meet Societal and Industrial needs.

MISSION OF THE DEPARTMENT

- M1: To provide high quality education and professional ethics to students through enhanced learning environment
- M2: To impart a creative environment towards centre of excellence in department with design skill and exposure for research.
- M3: To nurture required employable skills of students to satisfy the industry and social needs with ethical and human values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

- PEO1: Core Knowledge Development: Graduates will have enhanced engineering skills in the field of electronics, communication and interdisciplinary areas to serve the society with global standards.

- PEO2: Professional development: Graduates will apply the technical knowledge for continuous up gradation of their professional skills to become an inimitable employee, researcher or entrepreneur.
- PEO3: Analytical Thinking: Graduates will have analytic and thinking skills to provide the innovative solutions for industry and societal requirements.

PROGRAM OUTCOMES

Engineering students will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

- PSO1: To analyse, design and develop solutions by applying foundational concepts of electronics and communication engineering.
- PSO2: To apply design principles and best practices for developing quality products for scientific and business applications.

ABSTRACT

The Online Voting System is an innovative solution designed to facilitate secure, efficient, and accessible voting in elections, enabling voters to cast their ballots via the internet. Traditional voting systems often involve significant logistical challenges, including long wait times, physical polling stations, and concerns about voter accessibility. This system aims to address these issues by providing an electronic platform for conducting elections, ensuring anonymity, transparency, and real-time results. The system utilizes modern cryptographic techniques to secure voter information and prevent fraud, such as end-to-end encryption, digital signatures, and multi-factor authentication for voter verification. Additionally, it offers an intuitive user interface to ensure ease of use for voters across various demographics. With the integration of secure database management, the system guarantees data integrity and minimizes the risk of manipulation. The online voting system can be deployed for local, national, or organizational elections, providing a more accessible, efficient, and eco-friendly alternative to traditional voting methods. By embracing technology, this system promises to enhance voter participation, reduce election-related costs, and contribute to the overall democratization of the voting process.

ABSTRACT WITH POs AND PSOs MAPPING

ABSTRACT	POs MAPPED	PSOs MAPPED
The system solves real-world challenges related to voter authentication, preventing fraud, ensuring data security, and handling large-scale election data.	**2**	**1**
The project applies modern tools and technologies such as Java, SQL databases, and cryptographic libraries to develop the voting system.	**5**	**1**
The online voting system contributes to societal benefits by providing a secure, accessible, and scalable solution for conducting elections.	**6**	**2**

Note: 1- Low, 2-Medium, 3- High

SUPERVISOR **HEAD OF THE DEPARTMENT**

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CHAPTER 1

INTRODUCTION

1.1 Objective

The primary objective of the Online Voting System is to modernize the voting process by enabling secure, efficient, and accessible elections conducted over the internet. It aims to enhance accessibility by allowing voters to participate remotely, ensuring inclusivity for individuals with disabilities, those in remote areas, and people with tight schedules. The system prioritizes security and privacy through advanced encryption, authentication protocols, and digital signatures, safeguarding voter identities and ballots from unauthorized access or fraud. It also focuses on transparency and trust by offering auditable processes for vote counting and result generation. The system is designed to be cost-efficient by eliminating expenses related to physical polling stations and paper ballots, while delivering real-time results to minimize delays. An intuitive user interface ensures that all voters, regardless of technological proficiency, can participate easily. Additionally, the system reduces environmental impact by minimizing the need for paper-based resources and transportation. With scalability in mind, the system is adaptable for various election sizes, from small organizational votes to large national elections, ultimately contributing to a more accessible, secure, and sustainable voting process.

1.2 Overview

The Online Voting System is a digital platform designed to streamline the election process by enabling voters to cast their ballots securely and conveniently over the internet. It eliminates the need for traditional physical polling stations, allowing

individuals to vote from any location with internet access. The system is built with a strong focus on security, ensuring voter anonymity, data encryption, and authentication measures to prevent fraud and ensure the integrity of the election process. Real-time result tabulation and transparent procedures enhance trust and efficiency, while the system's user-friendly interface makes it accessible to people with varying levels of technical proficiency. By reducing logistical costs, minimizing environmental impact, and promoting greater voter participation, the Online Voting System offers a modern, reliable, and scalable solution for both small-scale and large-scale elections.

1.3 Java Programming Concepts

Classes and Objects:

Class: A blueprint for creating objects, defining properties and behaviours.

Object: An instance of a class, holding actual data and interacting with methods.

Inheritance:

A mechanism by which one class can inherit properties and behaviours (methods) from another class, promoting code reuse.

Polymorphism:

The ability of one method or class to take multiple forms. It includes method overloading (same method name, different parameters) and method overriding (same method signature in a subclass).

Encapsulation:

The practice of bundling data (variables) and methods that operate on the data into a single unit (class). It restricts access to some of an object's components by using access modifiers, protecting the object's integrity.

Abstraction:

Hiding the complex implementation details and exposing only the essential features of an object or class, typically achieved through abstract classes or interfaces.

Interfaces:

A reference type in Java that defines a contract of methods that a class must implement. A class can implement multiple interfaces.

Exceptions and Error Handling:

Java provides mechanisms for handling runtime errors using exceptions. The try-catch block is used to handle exceptions, and throw and throws are used to explicitly throw or declare exceptions.

Collections Framework:

A set of classes and interfaces in Java used for storing and manipulating groups of data, such as List, Set, Map, etc.

Multithreading:

The ability to run multiple threads (independent units of execution) simultaneously, improving performance and responsiveness in applications.

Garbage Collection:

An automatic memory management process in Java that reclaims memory from objects that are no longer in use, preventing memory leaks.

CHAPTER 2

PROJECT METHODOLOGY

2.1 Proposed Work

The proposed diagram for Java programming concepts would organize the core concepts at the centre, such as Classes and Objects, Inheritance, Polymorphism, Encapsulation, and Abstraction, as these are the foundational building blocks of Java. Surrounding these core concepts, we would place related areas such as Interfaces, Exceptions and Error Handling, Collections Framework, Multithreading, and Garbage Collection, which are important but depend on the core concepts for their implementation and understanding. Arrows would illustrate the relationships between these concepts: Inheritance and Polymorphism would point to Classes and Objects as they are applied within class structures; Encapsulation would also connect to Classes and Objects, as it is a practice implemented in classes to protect data. Interfaces would link to Abstraction and Polymorphism, highlighting their role in achieving both. Exceptions and Error Handling would be connected to Classes and Objects, indicating that exceptions occur in the context of objects. Multithreading would connect to Classes and Objects, as threads in Java are often represented as objects. Finally, Garbage Collection would point to Classes and Objects, emphasizing that it deals with the automatic memory management of these objects. The diagram can be structured in layers, with the core concepts at the centre and advanced topics like Multithreading and Exceptions surrounding them, showing how these build on or interact with the fundamental principles of Java programming.

The architecture diagram **fig 1.1** of an online voting system typically consists of multiple layers such as a user interface, application server, and database server. It ensures secure communication, voter authentication, vote submission, and results.

2.2 Block Diagram

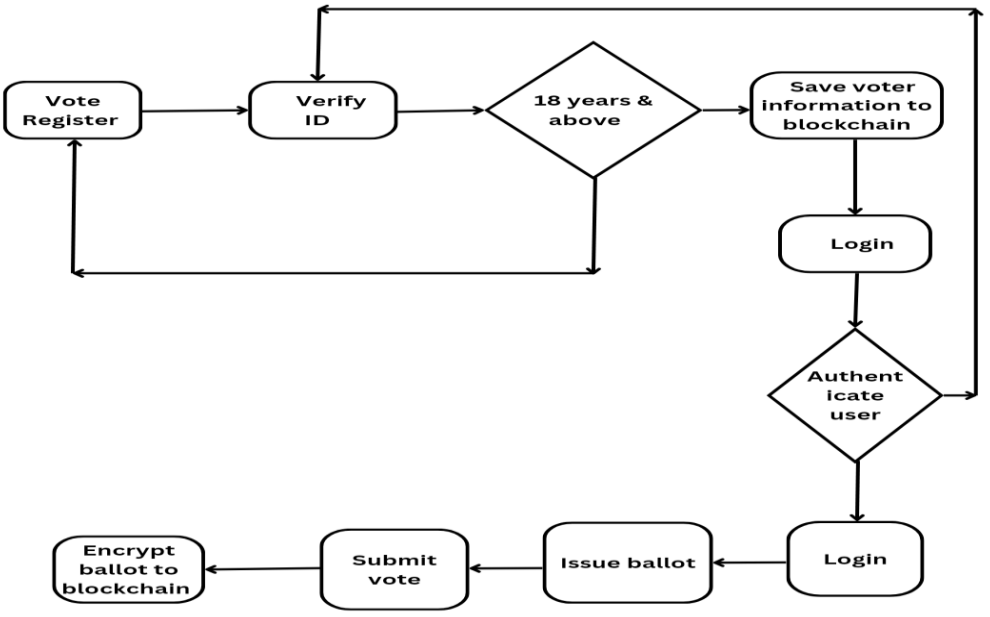

Fig.1.1 Architecture diagram of online voting system

CHAPTER 3

MODULE DESCRIPTION

3.1 User Authentication and Registration Module

The User Authentication and Registration Module is a critical component in any system that requires secure user access. This module allows users to create an account (registration) and securely log in (authentication) to access protected resources. During registration, the system collects user information such as username, email, and password, and may also include additional details like security questions or two-factor authentication (2FA) options for extra security. The password is typically stored in a hashed format to ensure privacy. In the authentication process, the user provides their credentials (usually username and password), which are verified against the stored data. If the credentials match, the user is granted access, and a session or token is created to maintain their logged-in state. The module may also incorporate features like password recovery, email verification, and account lockouts after multiple failed login attempts to enhance security and user experience. Overall, this module ensures that only authorized users can access the system while protecting sensitive user data.

3.2 Voter Database Management Module

The Voter Database Management Module is an essential component of an online voting system that manages and stores the details of registered voters securely. This module maintains a comprehensive database of voter information, including personal details (such as name, address, and voter ID), voting history, and authentication credentials. It ensures that each voter is uniquely identified and can only vote once, preventing fraud and duplication. The module supports operations such as adding new voters during

registration, updating existing voter records, and verifying voter identity during the login and voting processes. It also provides data retrieval and reporting capabilities for election officials to monitor voter participation and generate reports. The system emphasizes security, using encryption and secure access controls to protect sensitive voter data while ensuring that the database is accurate, up-to-date, and accessible only to authorized users.

3.3 Election Management Module

The Election Management Module is a crucial component of an online voting system that oversees the entire election process, from setting up the election to managing voting sessions and declaring results. It allows election administrators to create and configure different election types (e.g., local, national), define the list of candidates, and set voting rules and timelines. This module also handles the scheduling of voting windows, ensuring that elections are conducted within a specified period. It tracks voter participation, ensuring that only eligible voters can cast their ballots, and monitors real-time voting activity to prevent fraud. After the election concludes, the module facilitates secure vote counting, result tabulation, and generates comprehensive reports on the election outcome. Additionally, it ensures compliance with security protocols and transparency standards, enabling audit trails and real-time result access for both election officials and voters.

3.4 Security Module

The Security Module in an online voting system is designed to safeguard the entire voting process by implementing various security measures to protect voter data, ensure election integrity, and prevent unauthorized access. It employs robust authentication protocols such as username/password verification, multi-factor authentication (MFA), and biometric verification to ensure that only registered voters can access the system and cast their votes. The module also integrates data

encryption to protect sensitive information, such as personal details and vote choices, during transmission and storage. Additionally, it uses secure access control mechanisms to restrict access to critical system components, ensuring that only authorized personnel, like election officials, can modify or view sensitive election data.

In addition to safeguarding voter privacy and authentication, the Security Module ensures the integrity of the election process by utilizing technologies like blockchain or cryptographic hashing to verify that votes cannot be altered once cast. It also includes mechanisms to detect and prevent fraudulent activities, such as vote duplication or tampering, by employing real-time monitoring, anomaly detection algorithms, and audit trails for transparency. Furthermore, the module protects against denial-of-service attacks (DoS) and ensures the system is resilient to external threats through regular security updates and penetration testing. By combining advanced encryption, authentication, fraud detection, and access control, the Security Module provides a secure, trustworthy environment for conducting online elections.

3.5 Communication Module

The Communication Module in an online voting system facilitates secure and efficient interaction between various stakeholders, including voters, election administrators, and system components. It is responsible for managing the transmission of notifications, alerts, and updates throughout the election process. This includes sending voter registration confirmations, election reminders, voting instructions, and alerts regarding election deadlines. The module also enables secure communication channels for voter support, such as password recovery requests or resolving issues during the voting process. Additionally, it may support real-time communication for election officials to manage the voting process and address any technical difficulties.

By ensuring the timely and secure flow of information, the Communication Module enhances voter engagement and operational efficiency while maintaining the integrity of the election system.

The module may also provide notifications to remind voters about upcoming election dates or deadlines and alert them to any changes in the voting process. Additionally, it ensures secure communication for troubleshooting, enabling voters to receive assistance with login issues or technical problems during voting. By incorporating encrypted messaging, automated notifications, and real-time alerts, the Communication Module ensures that all parties are informed and supported throughout the election process, contributing to a smooth and efficient online voting experience.

The Communication Module in an Online Voting System facilitates secure interaction between users and the system by handling user authentication, vote submission, and result retrieval. It ensures data integrity through encrypted communication (e.g., HTTPS, SSL/TLS) and supports real-time updates (e.g., WebSockets or APIs) for displaying live results.

The module also includes error handling and feedback mechanisms to notify users of successful actions or issues. By enabling secure transmission of sensitive data, it ensures the system's reliability, prevents unauthorized access, and protects against vote manipulation, making the voting process seamless and trustworthy.

CHAPTER 4

RESULTS AND DISCUSSION

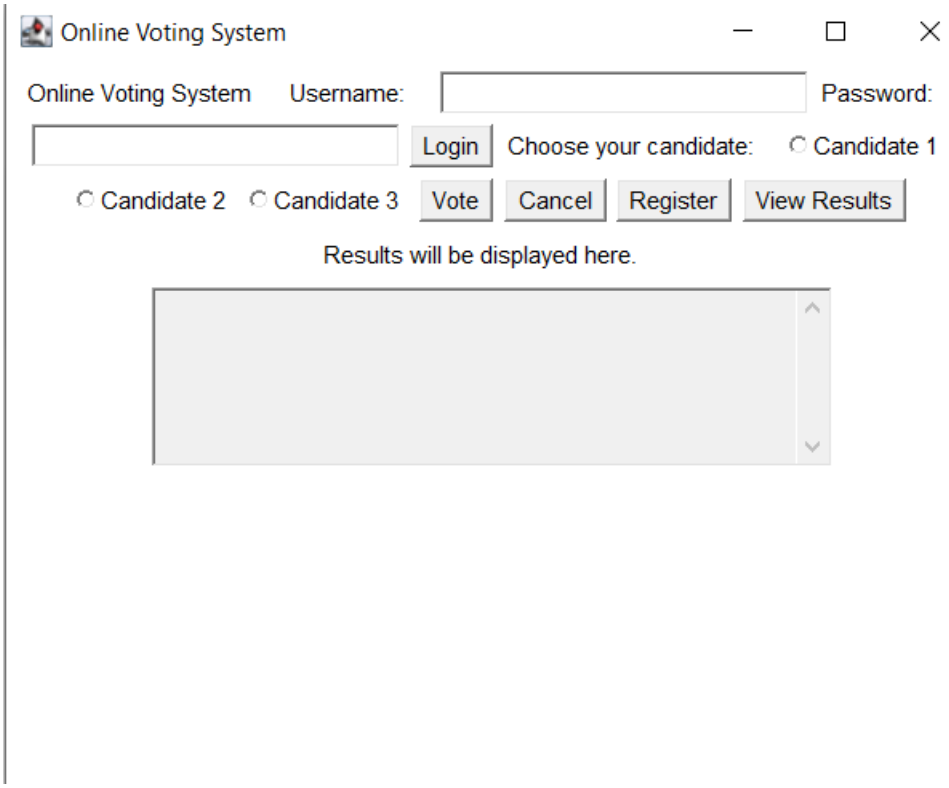

Fig 1.2 Frontend Design of Online Voting System

The system effectively manages voter authentication and prevents fraudulent activity through robust security measures like encryption and multi-factor authentication. Additionally, the election management module ensures smooth election setup and real-time result tabulation, reducing administrative overhead. However, challenges related to internet connectivity and system vulnerabilities may impact user experience and data security. Overall, the system offers a promising solution for modernizing the voting process but requires continuous monitoring and updates to maintain security.

The results of implementing the online voting system show a substantial increase in voter accessibility and convenience, as it allows individuals to participate in elections remotely, overcoming barriers such as geographical location and physical disabilities. The system's security features, including multi-factor authentication, data encryption, and fraud prevention mechanisms, ensure the integrity and confidentiality of the voting process. The election management module facilitates seamless election setup, real-time voting monitoring, and quick result generation, reducing manual effort and human error.

However, challenges remain, particularly regarding the potential for technical issues such as internet connectivity disruptions or system vulnerabilities that could affect voter experience and data security. While the system provides a promising solution to modernize elections, continuous updates and rigorous security testing are essential to address emerging threats and ensure the platform's reliability. The system’s scalability and adaptability for various types of elections offer a flexible framework, but its effectiveness hinges on maintaining robust infrastructure and security protocols.

The Online Voting System offers a convenient and secure way for users to cast their votes, eliminating the need for physical presence. It ensures accessibility by allowing voting from anywhere with connection. The system efficiently manages user registration, login, and vote tracking, improving overall voting transparency and accuracy. However, security concerns, such as preventing unauthorized access and ensuring data integrity, remain critical aspects to address for broader adoption.

CHAPTER 5

CONCLUSION

In conclusion, the online voting system offers a modern, efficient, and secure method for conducting elections, significantly enhancing voter accessibility and participation. By eliminating the need for physical polling stations, it provides a more convenient option for voters, including those in remote areas or with mobility challenges. The system's advanced security measures, such as data encryption, multi-factor authentication, and fraud detection, ensure the integrity of the voting process, making it a reliable alternative to traditional voting methods. Additionally, the election management module streamlines the process of election setup, monitoring, and result generation, reducing administrative workload and human errors. However, the implementation of an online voting system is not without its challenges. Issues such as system vulnerabilities, potential cybersecurity threats, and internet connectivity problems may impact user experience and the overall reliability of the system. Despite these hurdles, the advantages of online voting, such as increased voter turnout and cost-effectiveness, make it a promising solution for the future of elections. To ensure long-term success, ongoing maintenance, security updates, and rigorous testing are essential to address any emerging threats and maintain the system's trustworthiness and efficiency.

REFERENCES

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- Focuses on cryptographic methods for verifiable election systems.

Zhou, X., & Hwang, K. (2010). "A Survey of Cryptographic Protocols for Secure Online Voting." *Computers & Security*, 29(4), 321–334.

- Reviews cryptographic protocols used to secure online voting.

Törnblom, J., & Sundén, P. (2013). "Evaluating the Security of an Internet Voting System." *Journal of Computer Security*, 21(4), 563–589.

- Evaluates security aspects of internet-based voting systems.

Dhamija, R., & Tygar, J. D. (2003). "The Secure Voting System." *ACM Transactions on Information and System Security*, 6(3), 258–293.

- Discusses secure voting system design, focusing on authentication and encryption.

APPENDIX

(Coding)

```
import java.awt.*;
import java.awt.event.*;
import java.util.*;

class OnlineVotingSystemFrontend extends Frame implements ActionListener {

    // Declare components
    Label titleLabel, candidateLabel, resultsLabel;
    Button voteButton, cancelButton, registerButton, loginButton, viewResultsButton;
    CheckboxGroup candidateGroup;
    Checkbox candidate1, candidate2, candidate3;
    TextField usernameField;
    TextField passwordField;
    TextArea resultArea;

    static Map<String, String> userDatabase = new HashMap<>();  // Store
username:hashedPassword pairs
    static String loggedInUser = null;

    // Track votes for each candidate
    static Map<String, Integer> voteCount = new HashMap<>();  // Store votes for
each candidate

    // Constructor for the voting system frontend
    public OnlineVotingSystemFrontend() {
        setTitle("Online Voting System");
        setSize(500, 400); // Set the size of the window
        setLayout(new FlowLayout()); // Use FlowLayout for simple component
arrangement

        // Initialize components
        titleLabel = new Label("Online Voting System");
        candidateLabel = new Label("Choose your candidate:");
        resultsLabel = new Label("Results will be displayed here.");

        candidateGroup = new CheckboxGroup();
        candidate1 = new Checkbox("Candidate 1", candidateGroup, false);
```

```
candidate2 = new Checkbox("Candidate 2", candidateGroup, false);
candidate3 = new Checkbox("Candidate 3", candidateGroup, false);

usernameField = new TextField(20);
passwordField = new TextField(20);
passwordField.setEchoChar('*'); // Mask password input

voteButton = new Button("Vote");
cancelButton = new Button("Cancel");
registerButton = new Button("Register");
loginButton = new Button("Login");
viewResultsButton = new Button("View Results");

resultArea = new TextArea(5, 40); // Text area for displaying results
resultArea.setEditable(false); // Make it non-editable

// Add components to the frame
add(titleLabel);
add(new Label("Username:"));
add(usernameField);
add(new Label("Password:"));
add(passwordField);
add(loginButton);
add(candidateLabel);
add(candidate1);
add(candidate2);
add(candidate3);
add(voteButton);
add(cancelButton);
add(registerButton);
add(viewResultsButton);
add(resultsLabel);
add(resultArea);

// Add action listeners for the buttons
voteButton.addActionListener(this);
cancelButton.addActionListener(this);
registerButton.addActionListener(this);
loginButton.addActionListener(this);
viewResultsButton.addActionListener(this);
```

```
        setVisible(true); // Make the window visible

        // Pre-populate userDatabase with sample users (default users)
        userDatabase.put("john_doe", "securePass123");  // Username: john_doe,
Password: securePass123
        userDatabase.put("jas", "123");  // Username: jas, Password: 123
    }

    // Handle button click events
    @Override
    public void actionPerformed(ActionEvent e) {
        String command = e.getActionCommand();

        if (command.equals("Vote")) {
            // Handle voting logic
            if (loggedInUser != null) {
                Checkbox selectedCandidate = candidateGroup.getSelectedCheckbox();
                if (selectedCandidate != null) {
                    String candidate = selectedCandidate.getLabel();
                    voteCount.put(candidate, voteCount.getOrDefault(candidate, 0) + 1);
                    resultArea.append("Vote casted for " + candidate + "\n");
                } else {
                    resultArea.append("Please select a candidate to vote for.\n");
                }
            } else {
                resultArea.append("You must log in to vote.\n");
            }

        } else if (command.equals("Cancel")) {
            // Clear the form or reset the interface
            usernameField.setText("");
            passwordField.setText("");
            candidateGroup.setSelectedCheckbox(null);
            resultArea.setText("");
            loggedInUser = null;
            resultArea.append("Form reset. You can log in again.\n");

        } else if (command.equals("Register")) {
            // Logic for user registration (for simplicity, we just store username/password)
```

```
            String username = usernameField.getText();
            String password = passwordField.getText();
            if (!username.isEmpty() && !password.isEmpty()) {
                userDatabase.put(username, password);
                resultArea.append("User registered successfully!\n");
            } else {
                resultArea.append("Please provide both username and password.\n");
            }

        } else if (command.equals("Login")) {
            // Handle user login
            String username = usernameField.getText();
            String password = passwordField.getText();
            if (userDatabase.containsKey(username) &&
userDatabase.get(username).equals(password)) {
                loggedInUser = username;
                resultArea.append("Logged in as " + username + "\n");
            } else {
                resultArea.append("Invalid credentials. Try again.\n");
            }

        } else if (command.equals("View Results")) {
            // Display vote results
            if (voteCount.isEmpty()) {
                resultArea.append("No votes casted yet.\n");
            } else {
                resultArea.append("Voting Results:\n");
                for (Map.Entry<String, Integer> entry : voteCount.entrySet()) {
                    resultArea.append(entry.getKey() + ": " + entry.getValue() + " votes\n");
                }
            }
        }
    }

    // Main method to run the program
    public static void main(String[] args) {
        new OnlineVotingSystemFrontend(); // Create and display the voting system
frontend
    }
}
```