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in
Computer Science and Engineering

"A Secure E-Voting System"

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Certification of Project Work

The project titled "**A Secure E-Voting System**" by Md. Rejwan Ahmed, Roll no: 16102004, Registration no: 4856, Session: 2015-2016 has been satisfactorily accepted in partial fulfillment of the requirement for the degree of B.Sc. in Computer Science and Engineering.

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I hereby declare that the project work entitled **"A Secure E-Voting System"** submitted to the Department of Computer Science and Engineering, **Jatiya Kabi Kazi Nazrul Islam University**, is a record of an original work done by Md. Rejwan Ahmed under the guidance of **Dr. Tushar Kanti Saha,** Associate Professor, Department of Computer Science and Engineering, **Jatiya Kabi Kazi Nazrul Islam University** and this project is submitted in the partial fulfillment of the requirement for the degree of Bachelor of Engineering. I authorize **Jatiya Kabi Kazi Nazrul Islam University** to lend this project to other institutions or individual for the purpose of scholarly research. I further authorize **Jatiya Kabi Kazi Nazrul Islam University** to reproduce this project by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

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Md. Rejwan Ahmed

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Abstract

Today's world is a digital world. Information is stored in digital devices such as computer, mobile, etc. **"A Secure E-Voting System"** is a web-based voting system that will help us to manage the elections of a teachers' association in any university in Bangladesh easily and securely. Using our system, admin can add candidates, create an election, add voters, and finish the election. Every voter will have an individual random ID. Using this ID, he/she can vote to his/her chosen candidates. Our developed system counts all votes automatically after the election. This automated counting system saves our time a lot. This system is built using PHP, HTML, CSS, Bootstrap, and Java script.

Chapter-1

Introduction

1.1 Introduction

The World Wide Web opens new opportunities to interconnect electronic and classroom teaching and to promote active student participation. E-Voting or Electronic Voting refers to computerized voting machines that use electronic ballots rather than paper ones [1]. E-Voting system makes faster counting and delivering of election results. It increases trust in elections as human error is avoided. It also reduces ballot waste. There are number of e-voting systems available such as punch-card voting system, optical scan systems, direct-recording electronic voting machines voter- verified audit trail, etc [2].

This **"A Secure E-Voting System"** is developed to organize the online voting process securely and easily. It is a very cost-efficient and time reducing system. This system can calculate results within a second.

1.2 Motivation

At present there is no digital E-Voting system in **"Jatiya Kabi Kazi Nazrul Islam University"** to organize voting process of Teachers Association (TA). There is only an analog process which is very time-consuming to manage voting process because organizers have to count all votes manually to get the final result after the voting. There is also human trust issue. Therefore, **"A Secure E-Voting System"** is needed to organize voting process safely. This system will reduce our time because the election organizers will not have to count all the votes manually. This system will automatically provide the result. This system also helps us to know the result panel- wise. These are the reasons why we want to develop **"A Secure E-Voting System"**.

1.3 Purpose of the Project

The objectives of this project are shown below:

- Develop a system that makes it easier to organize the voting process.
- Voters can vote to his/her preferred candidates from anywhere of the world.
- All votes can be counted easily.
- Every user will have individual login ID.

- Admin has all the authority to add candidates and their designations, voters, start voting, finish voting, and so on.
- Create an easy to understand and user-friendly environment.
- Attractive user interfaces to navigate through the system.

1.4 Scope of the Project

The scope of this project is to create a web-based system that makes it easier to organize voting process. This system will provide individual ID to every registered user. The admin will register every user. Moreover, he/she has the ability to organize and start the voting process. Before the starting of the voting the admin will send the login ID to every registered user's mailbox. Once admin started the voting process every registered user can vote to his/her preferred candidates using his/her login ID.

All the web pages are created using PHP and MYSQL is used as the required database. Initially all the web pages are created along with the database tables. The required logic is added to improve the scope of the application and the database connections are established. Few test cases are created, and manual testing is used in this project. Test cases are created in a manner to check all the required field level validation and database validation. Once the application is created, the corresponding test cases are executed against couple of runs and the bugs are resolved if any identified. Once the testing is done, the final system is developed.

1.5 Overview of this report

The rest of this report is organized in the following ways.

Chapter-2: Requirements Specification

In this chapter, we have discussed about the requirements of the users and the system where a system has functional, non-functional, and domain requirements.

Chapter-3: Methodology

In this chapter, we have described about the software model we used for the system, its benefits, the reason behind selecting the model, and the software and hardware tools for the development.

Chapter-4: Software Design and Implementation

In this chapter, we have described about the architectural design, its data flow, and the actual development or implementation of the proposed system.

Chapter-5: Testing

In this section, we used software testing process for executing a program with the intent of finding and uncovering errors in a program. The testing makes the developed system error-free.

Chapter-6: Conclusion

In the conclusion part, we have discussed and shown the working level of the project, described about the scope and limitation, and further development of the system.

Chapter-2

Requirements Specification

A requirement specification is the process of writing down the user and system requirements in a document. Ideally, the user and system requirements should be clear, unambiguous, easy to understand, complete, and consistent.

In practice, this is difficult to achieve as stakeholders interpret the requirements in different ways and there are often inherent conflicts and inconsistencies in the requirements [3]. For a system the functional and nonfunctional requirements should be described so that they are understandable by system users who don't have detailed technical knowledge. Ideally, they should specify only the external behavior of the system. The requirement's document should not include details of the system architecture or design. System requirements are the expanded versions of the user requirements that are used by software engineers as the starting point for the system design. They add detail and explain how the user requirements should be provided by the system. They may be used as part of the contract for the implementation of the system and should therefore be a complete and detailed specification of the whole system.

2.1 Functional Requirements

The functional requirements for a system describe what the system should do. These requirements depend on the type of software being developed, the expected users of the software, and the general approach taken by the organization when writing requirements. When expressed as user requirements, functional requirements are usually described in an abstract way that can be understood by system users. However, more specific functional system requirements describe the system functions, its inputs and outputs, exceptions, etc., in detail.

Functional system requirements vary from general requirements covering what the system should do to very specific requirements reflecting local ways of working or an organization's existing systems.

2.2 Non-Functional Requirements

Non-functional requirements, as the name suggests, are requirements that are not directly concerned with the specific services delivered by the system to its users. They may relate to

emergent system properties such as reliability, response time, and store occupancy. Alternatively, they may define constraints on the system implementation such as the capabilities of I/O devices or the data representations used in interfaces with other systems. Non-functional requirements are often more critical than individual functional requirements.

Non-functional requirements arise through user needs, because of budget constraints, organizational policies, the need for interoperability with other software or hardware systems, or external factors such as safety regulations or privacy legislation.

The implementation of the requirements may be diffused throughout the system. There are two reasons for this:

1. Non-functional requirements may affect the overall architecture of a system rather than the individual components.
2. A single non-functional requirement, such as a security requirement, may generate a number of related functional requirements that define new system services that are required.

2.2.1 Types of Non-Functional Requirements

Non-functional requirements are three types.

2.2.1.1 Product Requirements

These requirements specify or constrain the behavior of the software. Examples include performance requirements on how fast the system must execute and how much memory it requires, reliability requirements that set out the acceptable failure rate, security requirements, and usability requirements.

Product requirements of the "A Secure E-Voting System" are:

User Modules:

- User can login with given Id.
- User can vote to his/her preferred candidate.
- User can logout.

Admin Modules:

- Admin can login and logout.
- Admin can register, modify, and delete a user.
- Admin can add, modify, and delete a designation.
- Admin can add, modify, and delete a department.
- Admin can create panel.
- Admin can organize and start voting process.
- Admin can send the login ID to every registered user in their mailbox.
- Admin can view the details of an election and also can delete that election.
- Admin can download all the ballot papers of an election.
- Admin can change username and password of this system.
- Admin can add, and delete email for sending login ID and sending confirmation mail.

To design this **"A Secure E-Voting System"** the above modules are required as product requirements.

2.2.1.2 Organizational Requirements

These requirements are broad system requirements derived from policies and procedures in the customer's and developer's organization. Examples include operational process requirements that define how the system will be used, development process requirements that specify the programming language, the development environment or process standards to be used, and environmental requirements that specify the operating environment of the system.

The organizational requirements of our system are:

Software Requirements:

Specifications	Description
Platform:	Web Server (Apache)
Database:	MYSQL
Browsers:	Firefox, Google Chrome, Opera Mini.

Hardware Requirements:

This system is an online-based system and it is already uploaded to a domain. Therefore, any device able to connect to the Internet and browse pages, can be used to access this system. To access and use the system properly, a computing device like a computer, mobile, or a laptop is needed. There is no specific configuration or platform for this proposed system. Any computer or laptop which is able to connect to the internet is able to use this system.

2.2.1.3 External Requirements

This broad heading covers all requirements that are derived from factors external to the system and its development process. These may include regulatory requirements that set out what must be done for the system to be approved for use by a regulator, such as a central bank; legislative requirements that must be followed to ensure that the system operates within the law, and ethical requirements that ensure that the system will be acceptable to its users and the public.

Chapter-3

Methodology

In this chapter, we discuss how to define a system model. It also discusses about software and hardware tools that need for system development. It also discusses the reason behind selecting the model.

3.1 Software Model

A system model is the conceptual model because of system modeling that describes and represents a system. A system comprises multiple views such as planning, requirement (analysis), design, implementation, deployment, structure, behavior, input data, and output data views. A system model is required to describe and represent all these multiple views [4].
There are various software development models or methodologies [5]. They are as follows:

- Waterfall model
- V model
- Incremental model
- RAD model
- Agile model
- Iterative model
- Spiral model
- Prototype model

In this project we have used the "incremental model" for the processing of **"A Secure E-Voting System"**.

3.1.1 The Incremental Model

In incremental model the whole requirement is divided into various parts. Multiple development cycles take place here, making the life cycle a "multi-waterfall" cycle. Cycles are divided up into smaller, more easily managed modules. Each module passes through the requirements, design, implementation, and testing phases. A working version of software is produced during the first module, so we have working software early on during the software life cycle. Each subsequent release of the module adds functionalities to the previous release. The process continues till the complete system is achieved [6].

In the diagram below when we work incrementally, we are adding piece by piece but expect that each piece is fully finished. In adding the pieces until it's complete.

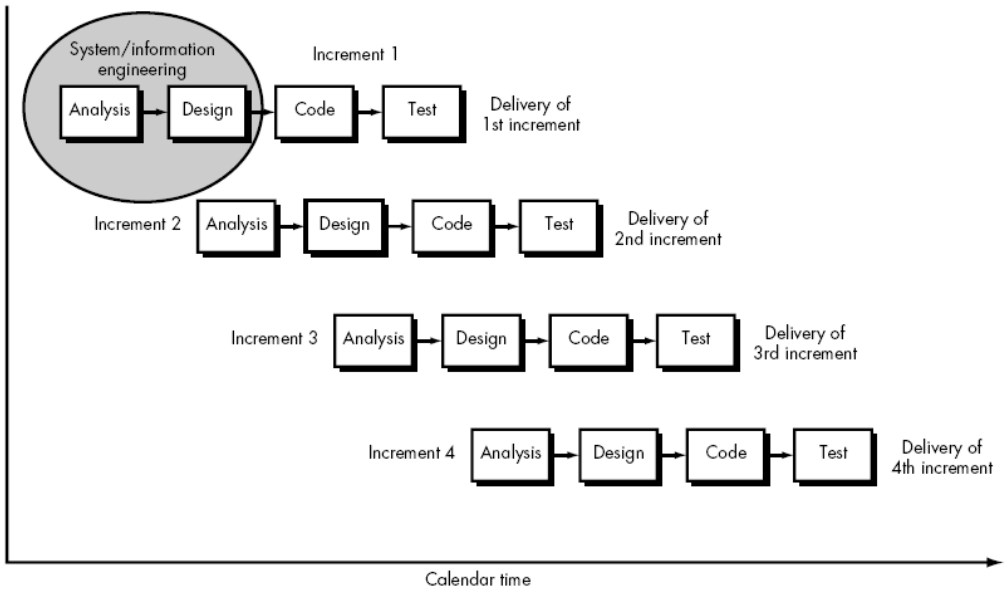


Figure 3.1: The Incremental Model

3.1.2 Benefits of Incremental Model

- Generates working software quickly and early during the software life cycle.
- More flexible and less costly to change scope and requirements.
- Easier to test and debug during a smaller iteration.
- Customer can respond to each built.
- Lowers initial delivery cost.
- Easier to manage risk because risky pieces are identified and handled during iteration.

3.1.3 Selecting the Incremental Approach

It is necessary to determine whether the system to be built is suitable for incremental or not. This is decided depending on application area, complexity, and projects characteristics. We choose it for the following reasons:

- Requirements of the complete system are clearly defined and understood.

- Incremental model improves the quality of software day by day.
- Major requirements must be defined. However, some details can evolve with time.
- There is a need to get a product to the market early.
- A recent technology is being used.
- Resources with needed skill set are not available.
- There are some high-risk features and goals.

3.2 Software Development Tools

A software development tool is a computer program that software developers use to create, debug, maintain, or otherwise support other programs and applications.

The term usually refers to relatively simple programs, which can be combined to accomplish a task, such as one might use multiple hand tools to fix a physical object. The ability to use a variety of tools productively is one hallmark of a skilled software engineer.

The most basic tools are a source code editor and a compiler or interpreter, which are used ubiquitously and continuously. Other tools are used more or less depending on the language, development methodology, and individual engineer, and are often used for a discrete task, like a debugger or profiler. Tools may be discrete programs, executed separately – often from the command line – or may be parts of a single large program, called an integrated development environment (IDE).

Therefore, to develop this system the required tools will be hardware, software, programming language.

3.2.1 Hardware Support

- Processor –Core-i3 or i5
- Hard Disk – Minimum 5 GB Space
- Memory – Minimum 1GB RAM

3.2.2 Software Support

- Web server - Apache
- Database - MYSQL
- Notepad++
- Google Chrome/Mozilla Firefox

3.2.3 Programming Language

As our system is in web platform, we used PHP language to develop our system's back-end. We also use MYSQL as database. For developing front-end, we used HTML, CSS, Bootstrap Framework, and JavaScript.

Chapter-4

Software Design and Implementation

Software design is the process by which an agent creates a specification of a software artifact, intended to accomplish goals, using a set of primitive components and subject to constraints [7]. Software design may refer to either "all the activity involved in conceptualizing, framing, implementing, commissioning, and ultimately modifying complex systems" or "the activity following requirements specification and before programming".

4.1 Architectural Design

Architectural design is concerned with understanding how a system should be organized and designing the overall structure of that system [8]. In the model of the software development process, architectural design is the first stage in the software design process. It is the critical link between design and requirements engineering, as it identifies the main structural components in a system and the relationships between them. The output of the architectural design process is an architectural model that describes how the system is organized as a set of communicating components. Architectural decomposition is usually necessary to structure and organize the specification.

In practice, conceptual views are almost always developed during the design process and are used to support architectural decision making. They are a way of communicating the essence of a system to different stakeholders. During the design process, some of the other views may also be developed when different aspects of the system are discussed, but there is no need for a complete description from all perspectives.

4.1.1 Architectural data flow of system

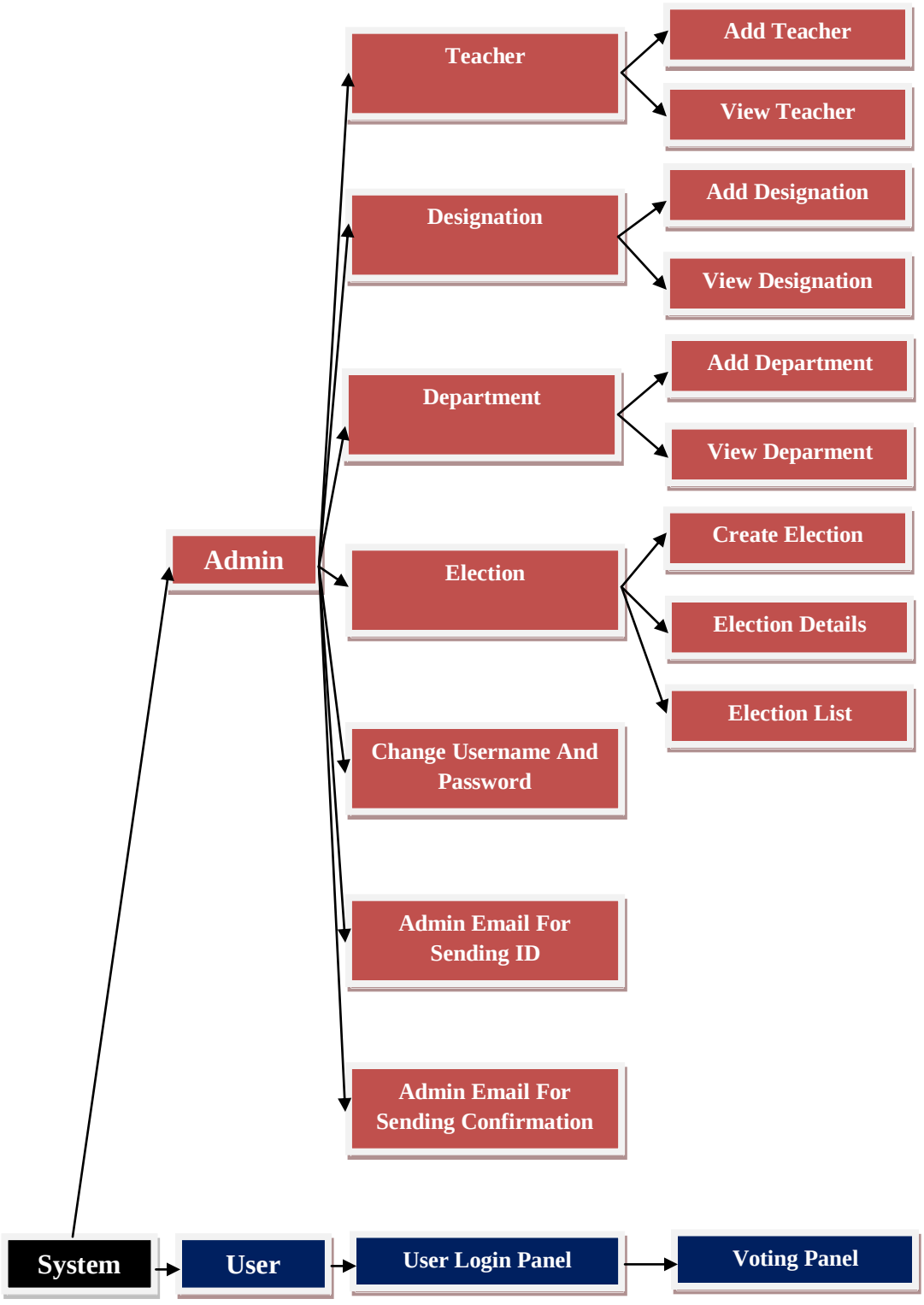


Figure 4.1: Architectural Diagram

To implement the system, we need to use here UML diagram which has become a standard modeling language for object-oriented modeling. When developing system models, it can often be flexible in the way that the graphical notation is used. It does not always need to stick rigidly to the details of a notation. The detail and rigor of a model depends on how we intend to use it.

4.2 Development of the System

In order to achieve deliverable of acceptance and meeting of objectives, the new system being built must be tested. The construction phase does two things: builds and tests a functional system that fulfills business or organizational design requirements and implements the interface between the new system and the existing production system. The project team must construct the database, application programs, user and system interfaces, and networks. Developing a system includes programs and structured databases.

The stages of development of our system are described below:-

4.2.1 User Interface

User interface is the communication between a user and the system. In our proposed system, there are two types of users: admin and voters.

4.2.1.1 Admin View

Admin Login

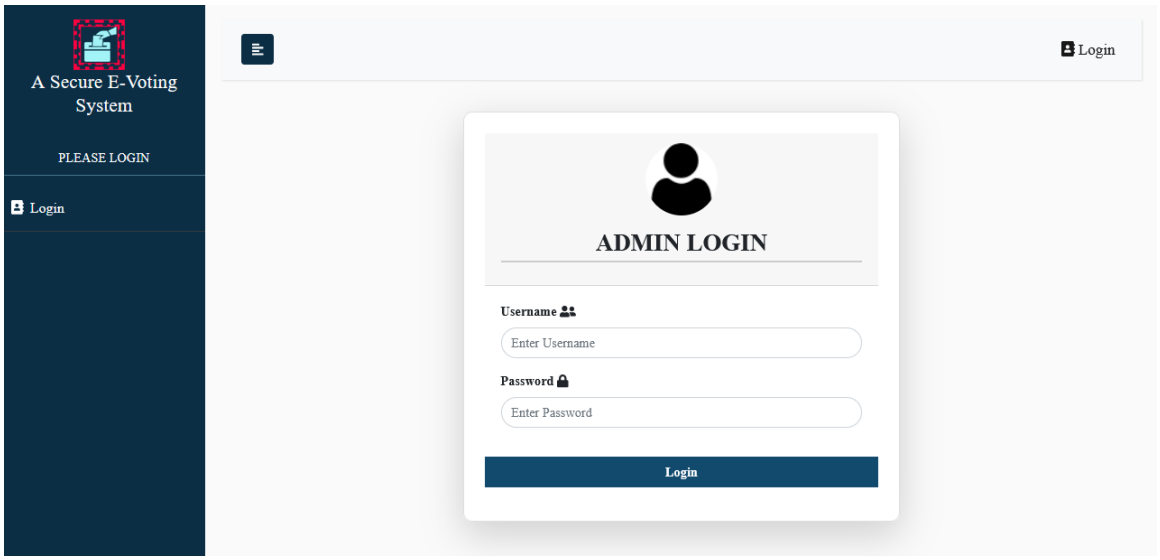


Figure 4.2: Admin Login

Figure 4.2 shows the admin login page. Through this page, admin can login to his panel.

Admin Home Page

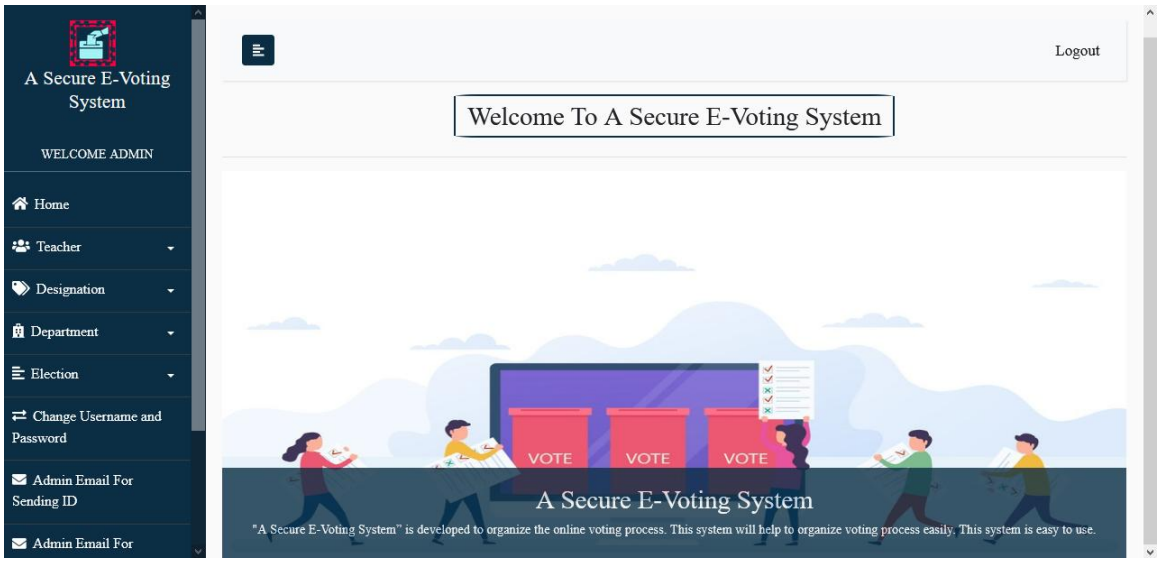


Figure 4.3: Admin Home Page

Figure 4.3 shows that after providing username and password the admin will be redirected to this page which is admin home page.

Teacher Registration

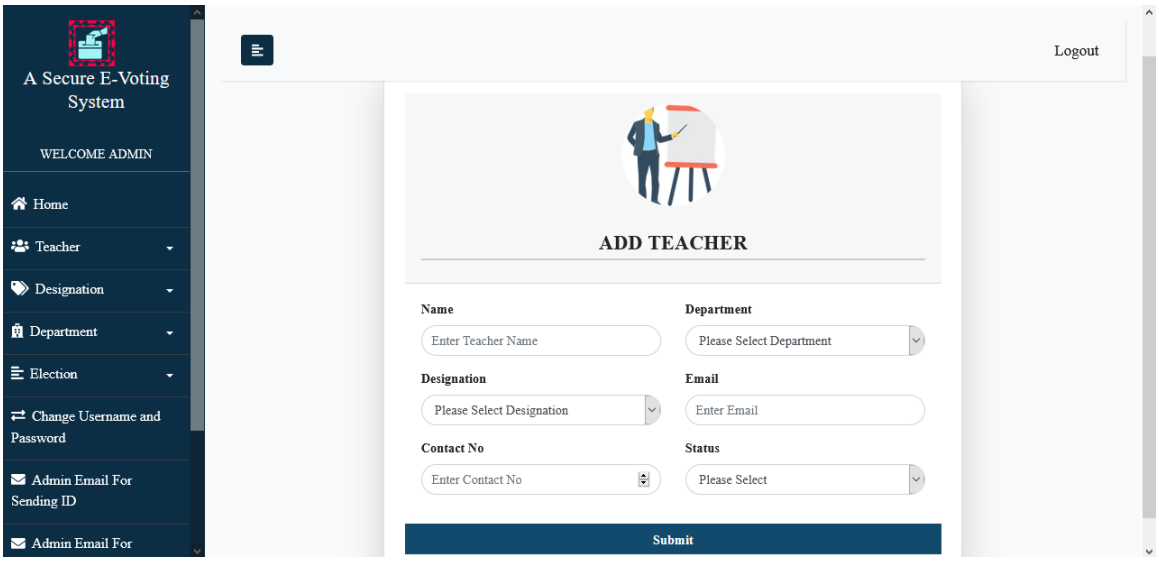


Figure 4.4: Teacher Registration

Figure 4.4 shows the page for registering a teacher.

Teacher Information

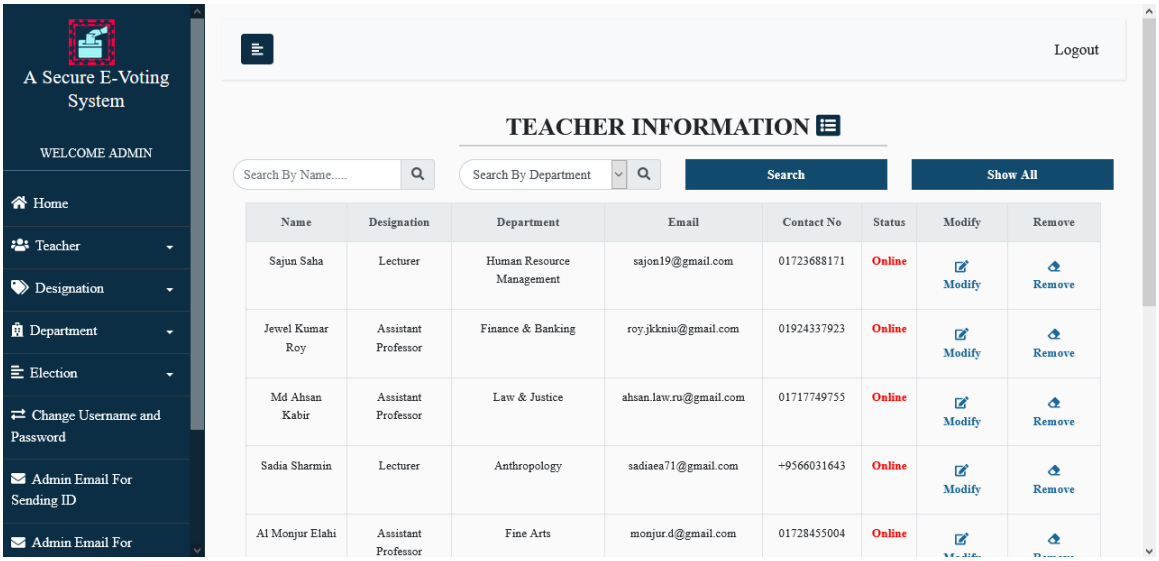


Figure 4.5: Teacher Information

Figure 4.5 shows the information of registered teachers. Teacher's information can be modified and can also be removed.

Modify Teacher Information

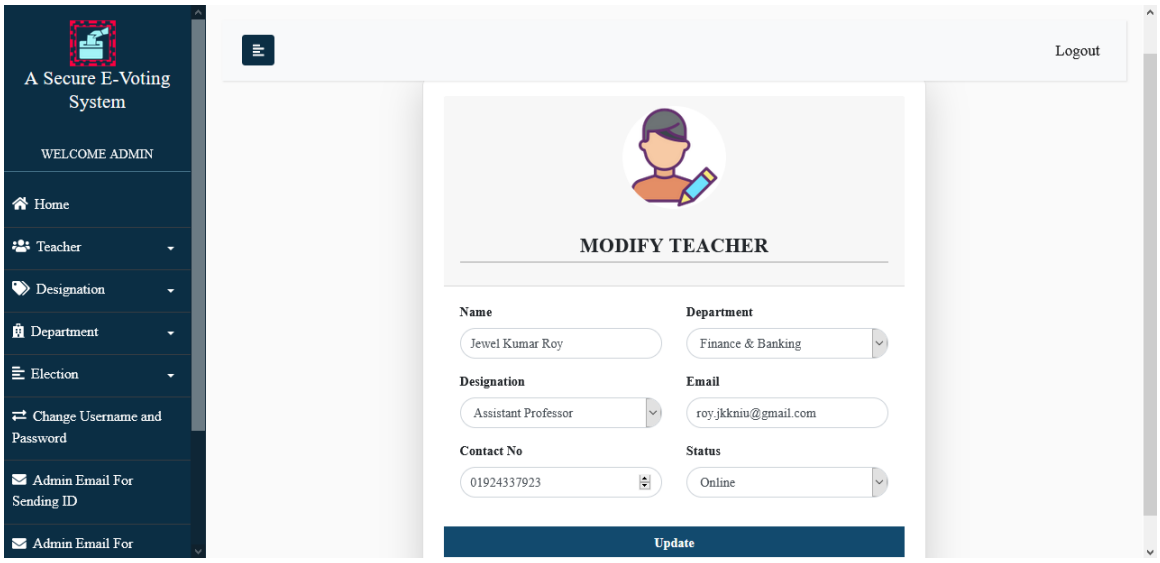


Figure 4.6: Modify Teacher Information

Figure 4.6 shows that by this page teacher's information can be modified.

Add Designation

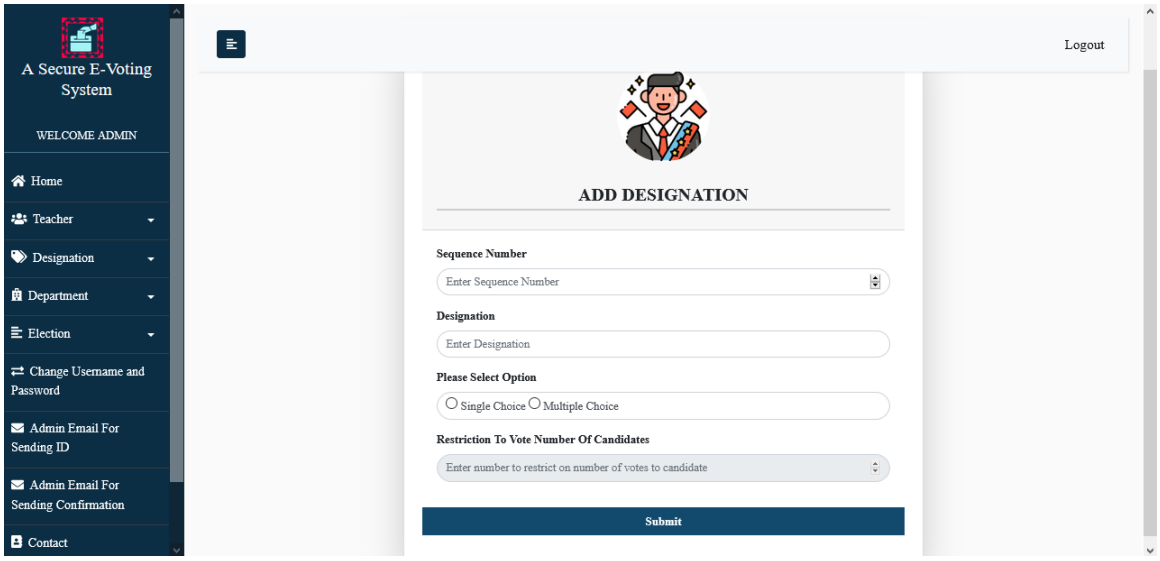


Figure 4.7: Add Designation

Figure 4.7 shows the page which is used for adding an election designation.

Election Designation Information

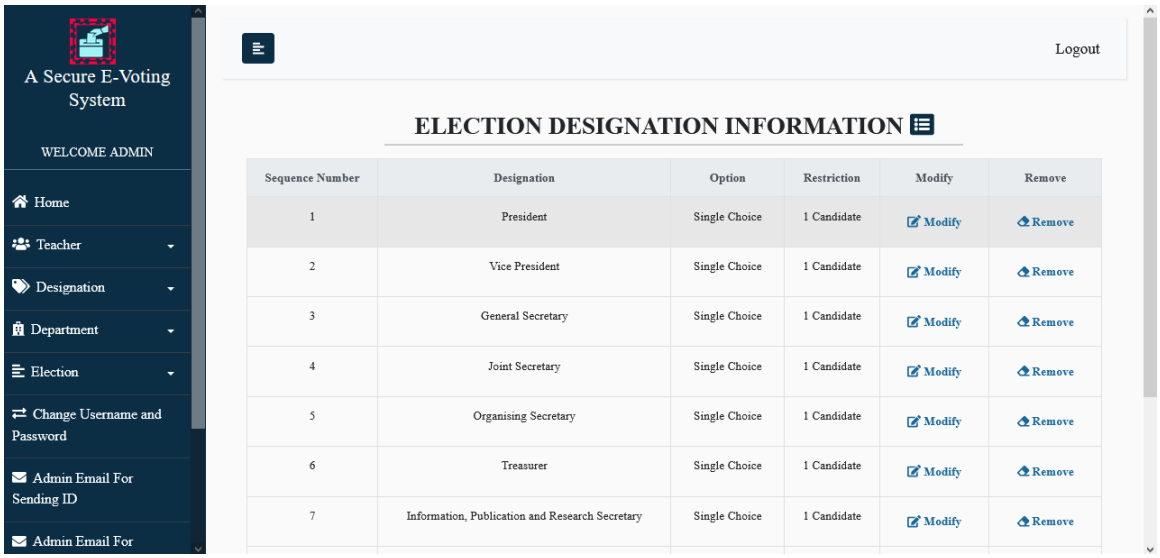


Figure 4.8: Election Designation Information

Figure 4.8 shows the information of election designation. Election designation information can be modified and can also be removed.

Modify Designation

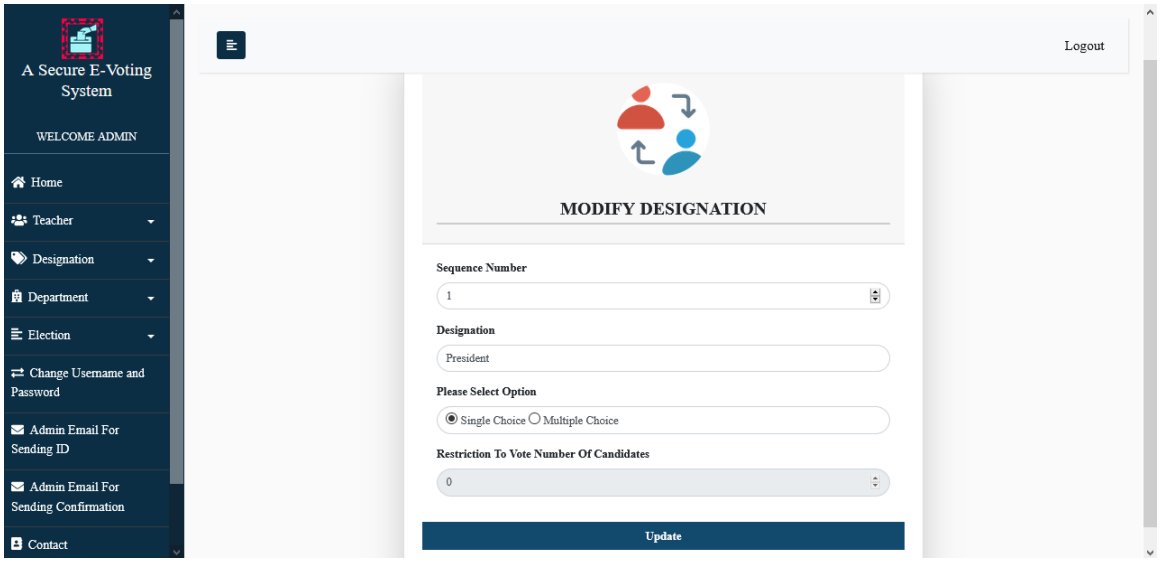


Figure 4.9: Modify Designation

Figure 4.9 shows the page for modifying election designation.

Add Department

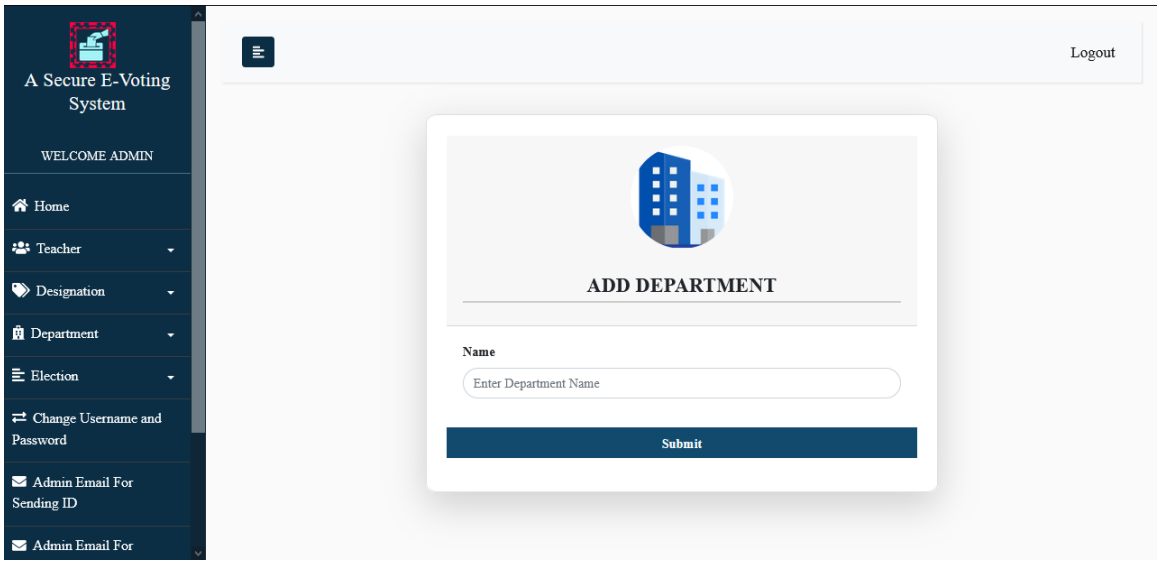


Figure 4.10: Add Department

Figure 4.10 shows the page for adding a department.

Department Information

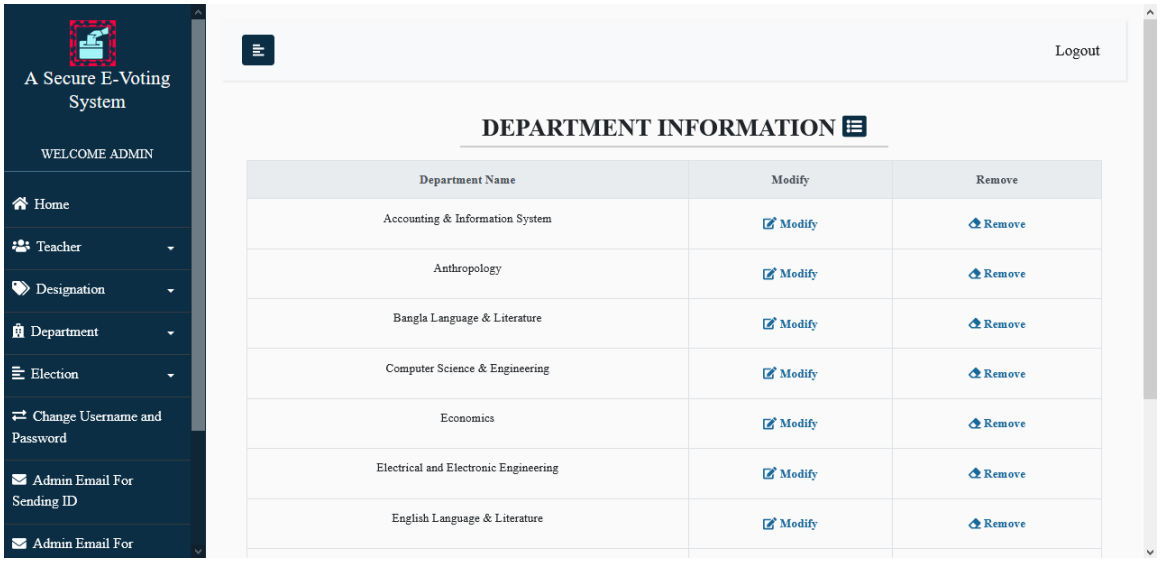


Figure 4.11: Department Information

Figure 4.11 shows the information of different departments.

Modify Department

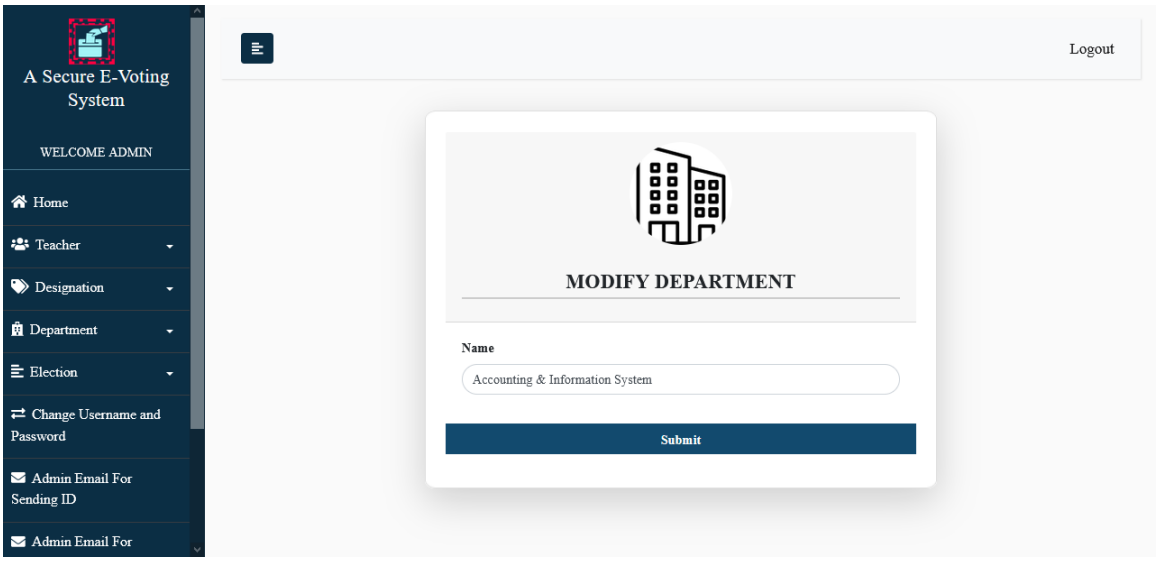


Figure 4.12: Modify Department

Figure 4.12 shows the page for modifying department information.

Create Election Panel

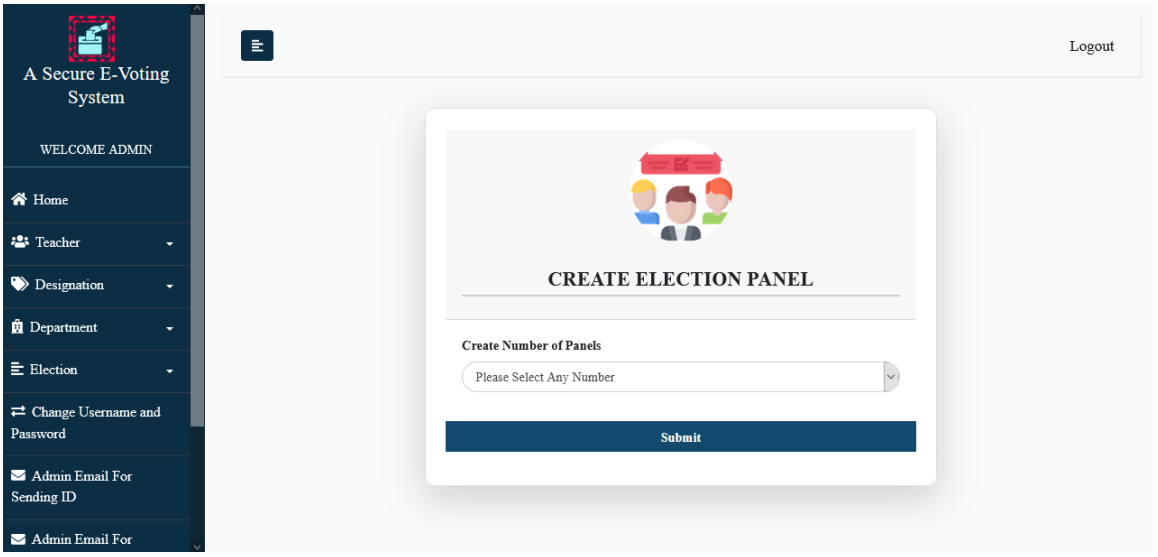


Figure 4.13: Create Election Panel

Figure 4.13 shows the page which is used for creating election panels.

Create Election

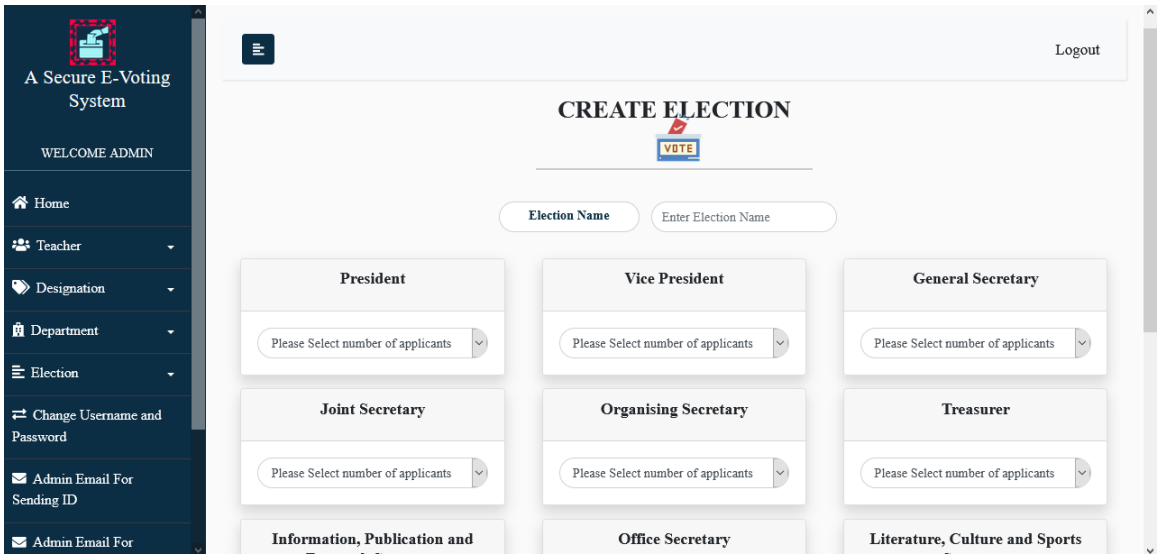


Figure 4.14: Create Election

Figure 4.14 shows the page which is used for creating election.

Create Election Preview

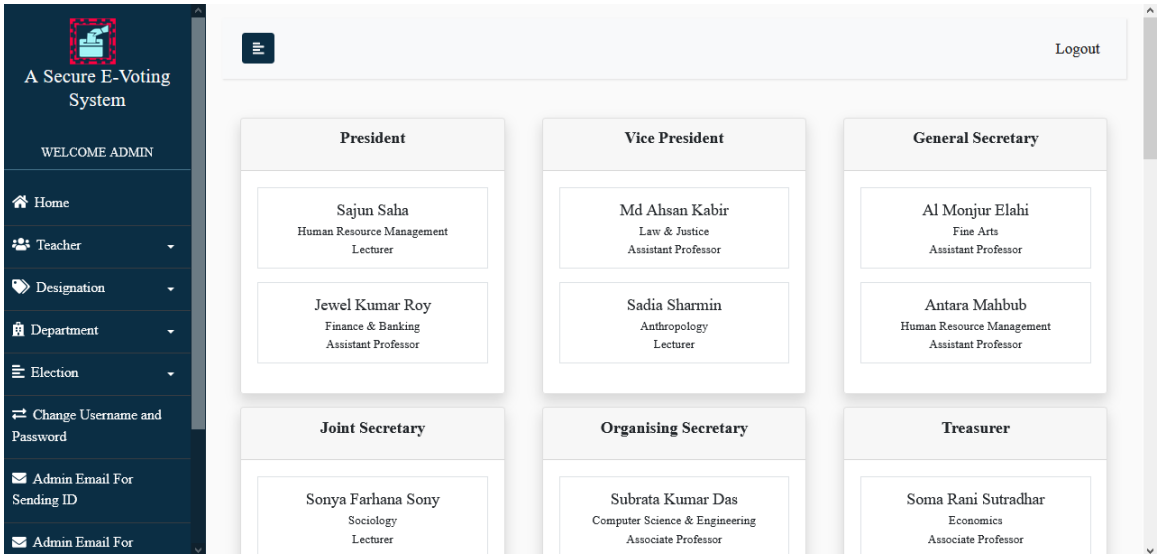


Figure 4.15: Create Election Preview

Figure 4.15 shows the preview page of create election page. This page is for determining whether admin has selected the unique candidate for a post or not.

Pending Election

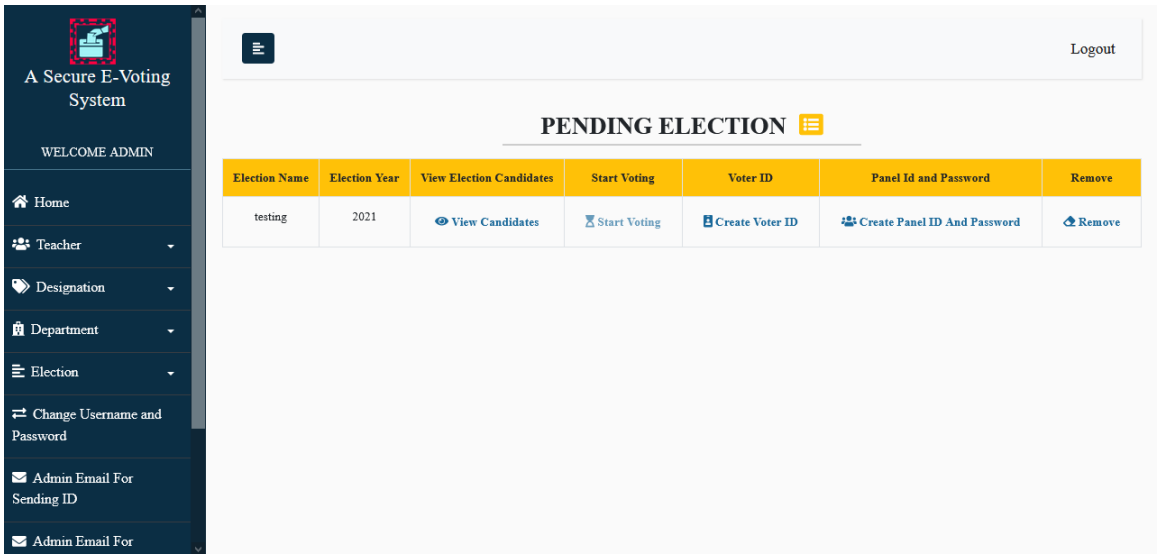


Figure 4.16: Pending Election

Figure 4.16 shows the page of pending election list. Admin can view candidates list, start voting process, create voter id, create panel id and password, and also can remove this election through this page.

View Candidates List

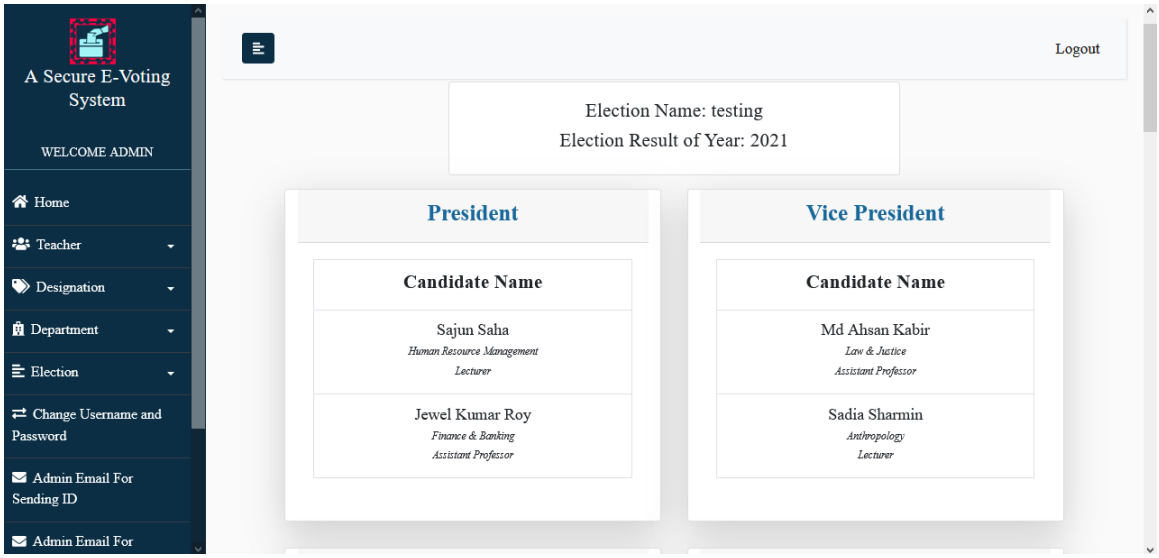


Figure 4.17: View Candidates List

Figure 4.17 shows the page of the candidates list that admin has created for an election.

Create Voter ID

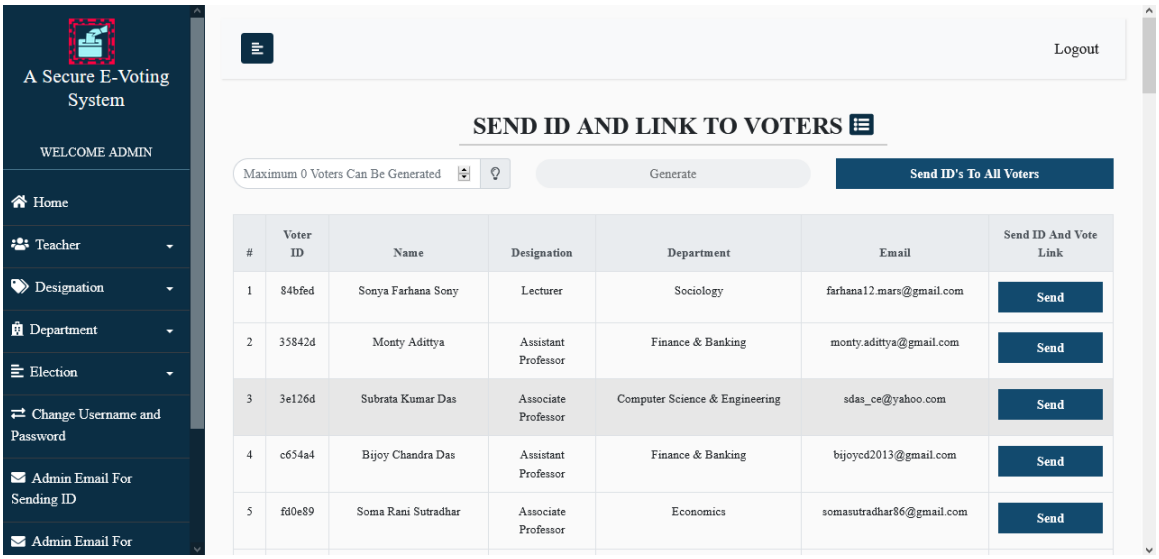
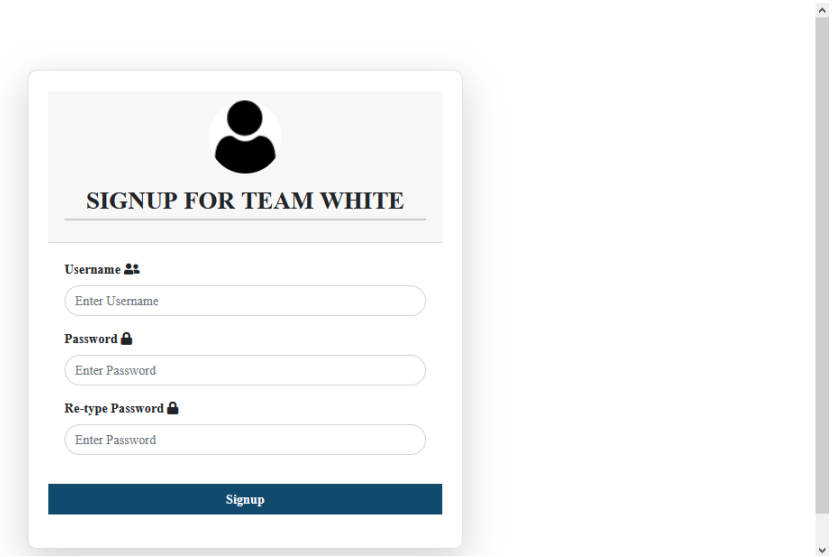


Figure 4.18: Create Voter ID

Figure 4.18 shows the page which is used for creating and sending voter id to the voters who are registered in the system.

Create Panel ID and Password



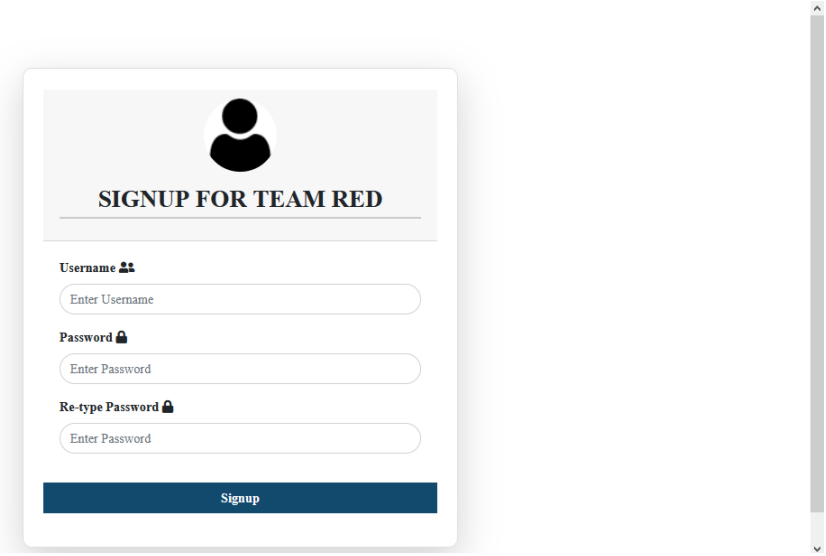


Figure 4.19: Create Panel ID and Password

Figure 4.19 shows the page for creating panel id and password which will be used later for finishing the voting process.

Change Username and Password

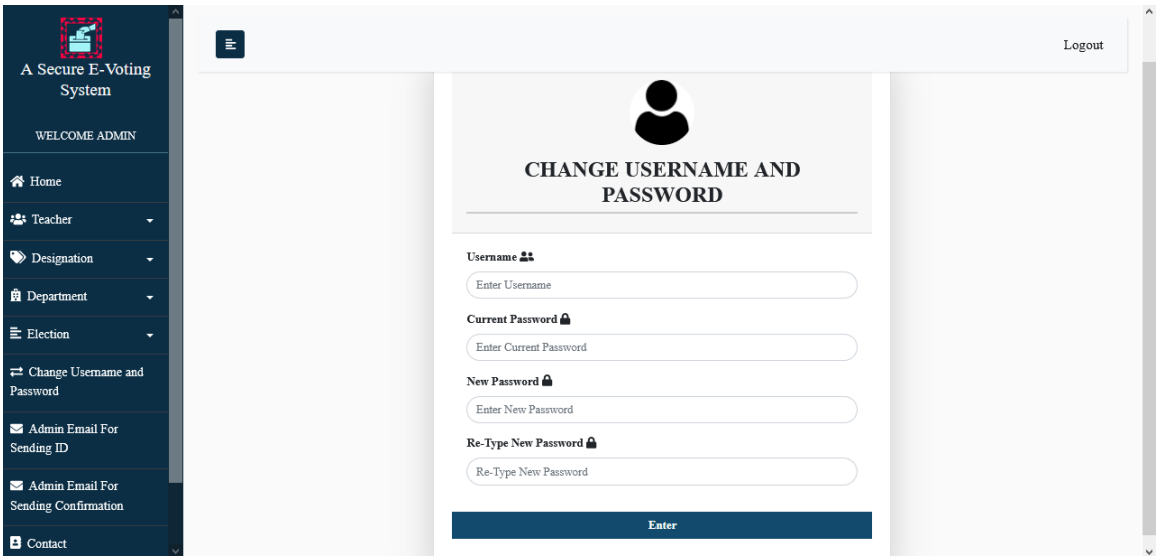


Figure 4.20: Change Username and Password

Figure 4.20 shows the page for changing username and password of the admin panel.

Email Information for Sending ID

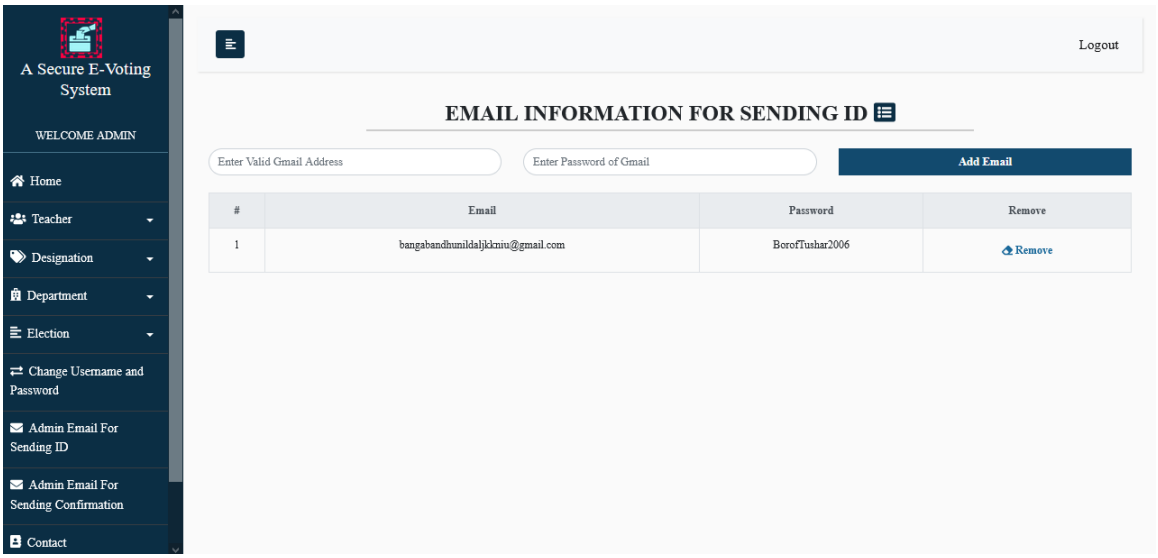


Figure 4.21: Email Information for Sending ID

Figure 4.21 shows the page for showing the information of email which has been added in the system for sending voter id to the voter's mailbox.

Email Information for Sending Confirmation Message

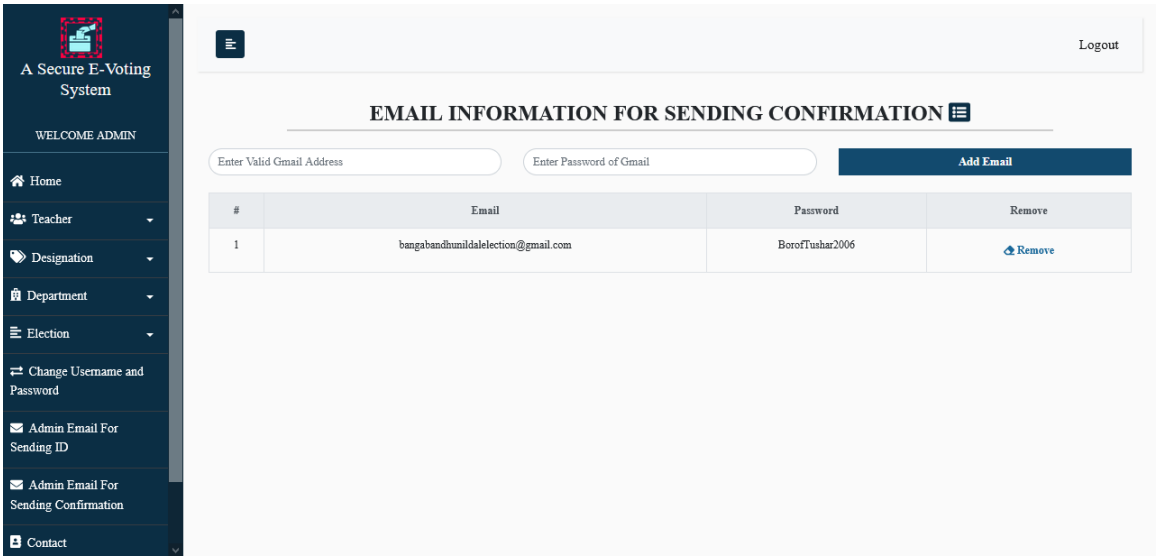


Figure 4.22: Email Information for Sending Confirmation Message

Figure 4.22 shows the page which is showing the information of email which has been added in the system for sending confirmation message to the voter's mailbox that their voting process has been successfully completed.

Contact

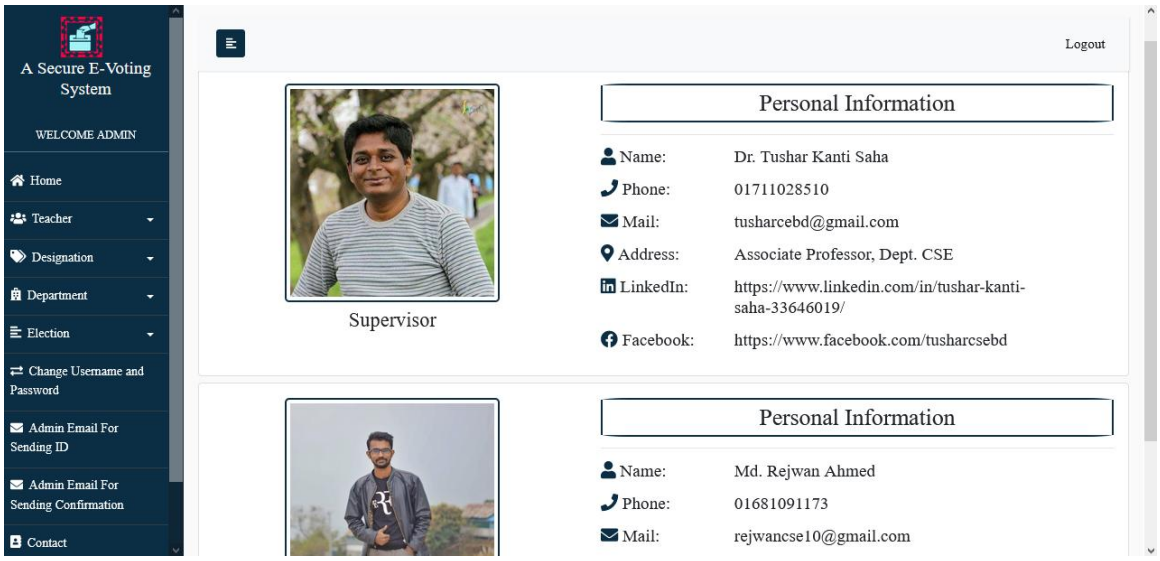


Figure 4.23: Contact

Figure 4.23 shows the information of supervisor and developer details.

Voting Process Is Going On

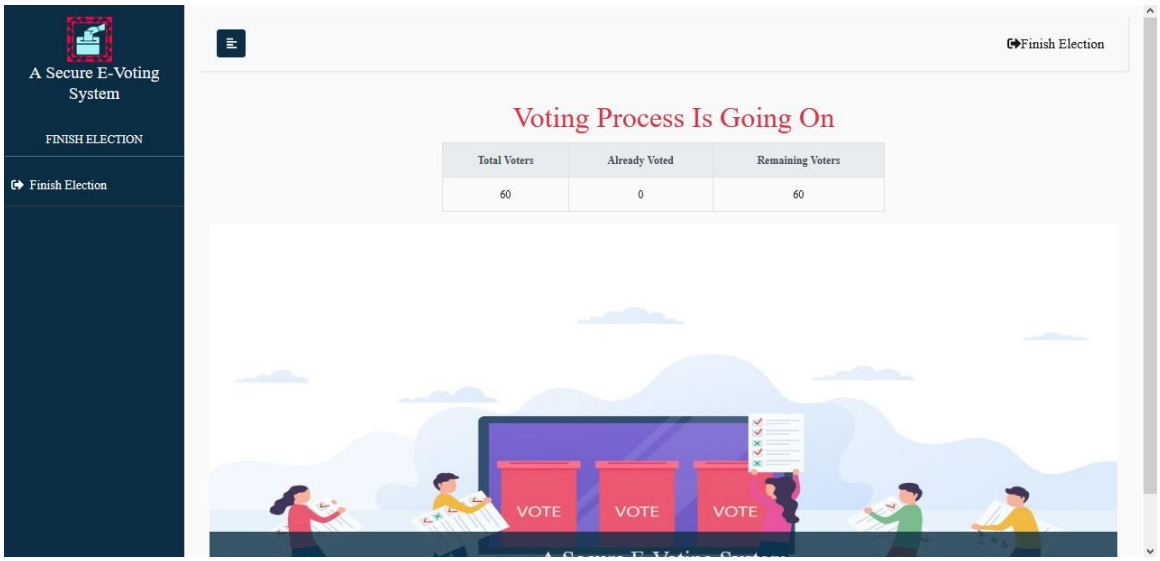


Figure 4.24: Voting Process Is Going On

Figure 4.24 shows that the voting process is going on. Now admin can't login to the admin panel. He can login only when the voting process will be finished.

Login Pages for Finishing Voting Process

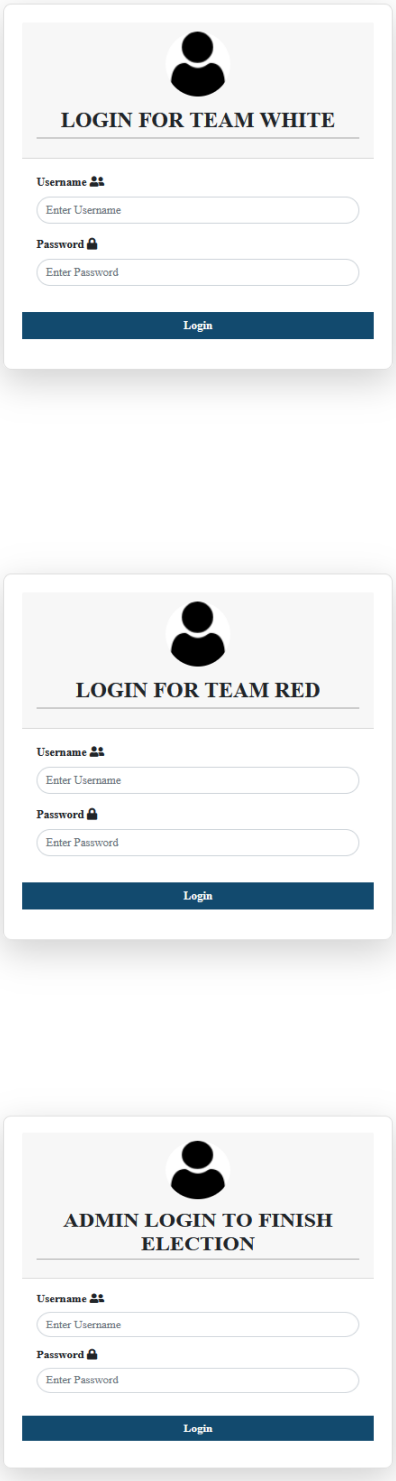


Figure 4.25: Login Pages for Finishing Voting Process

Figure 4.25 shows all the pages which are required to finish the voting process.

Finished Election List

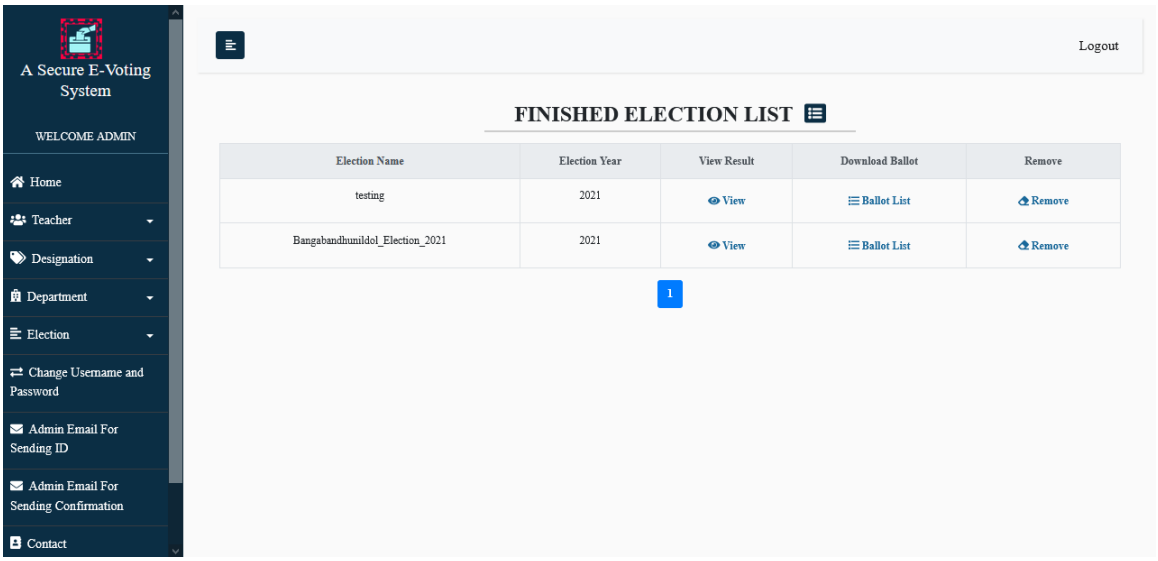


Figure 4.26: Finished Election List

Figure 4.26 shows the list of finished election.

Election Result

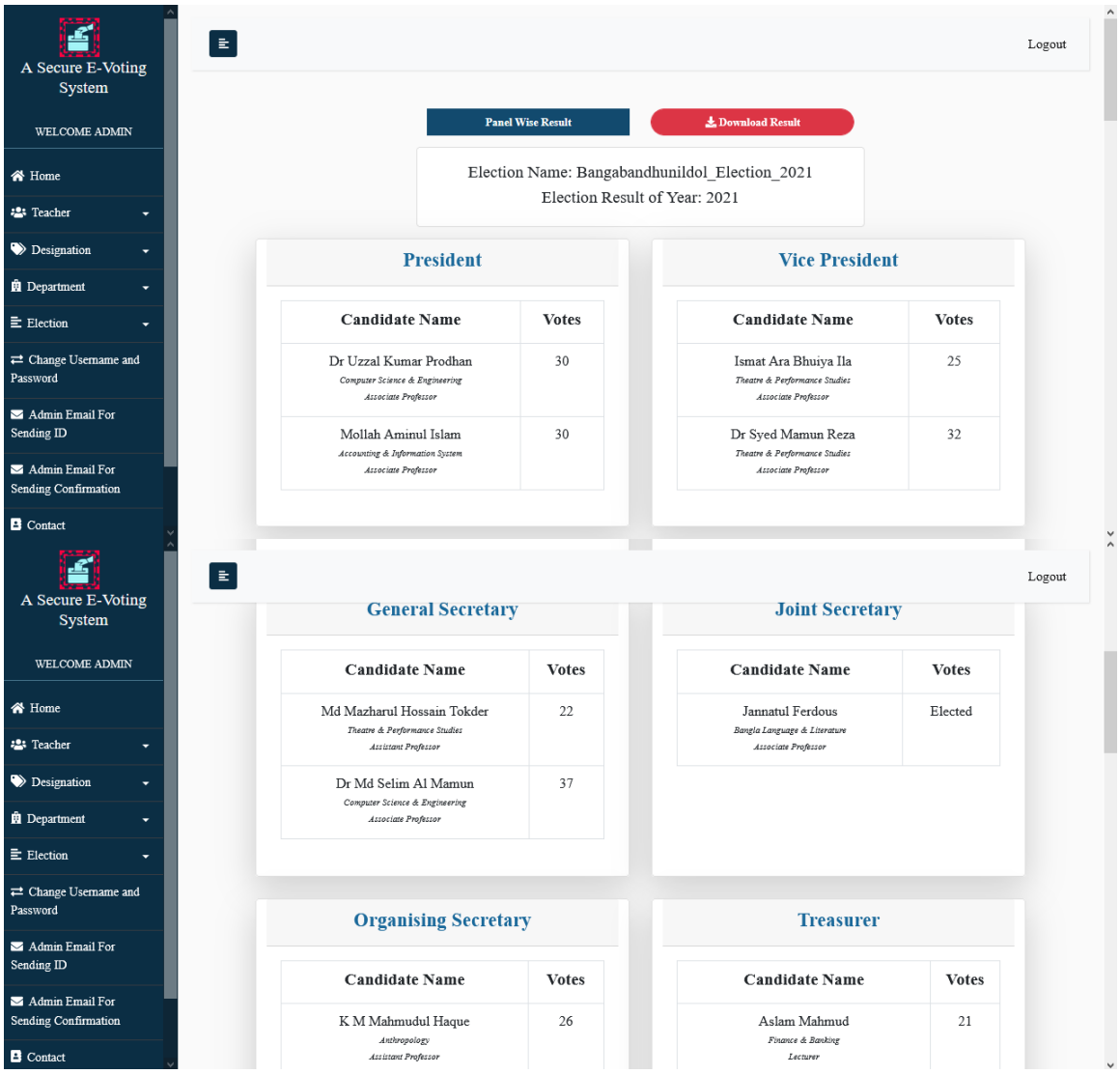


Figure 4.27: Election Result

Figure 4.27 shows the election result.

Ballot Paper PDF View

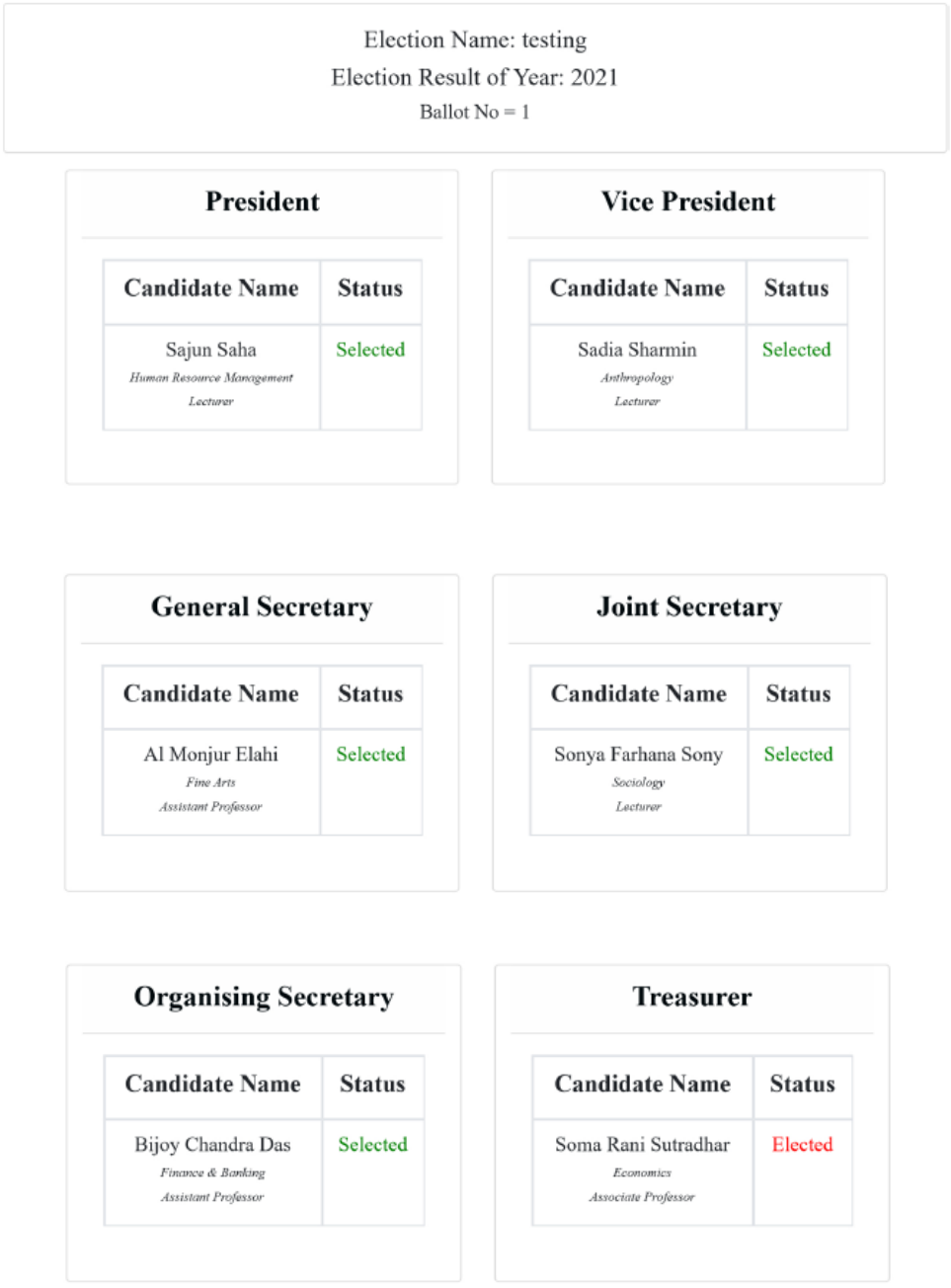
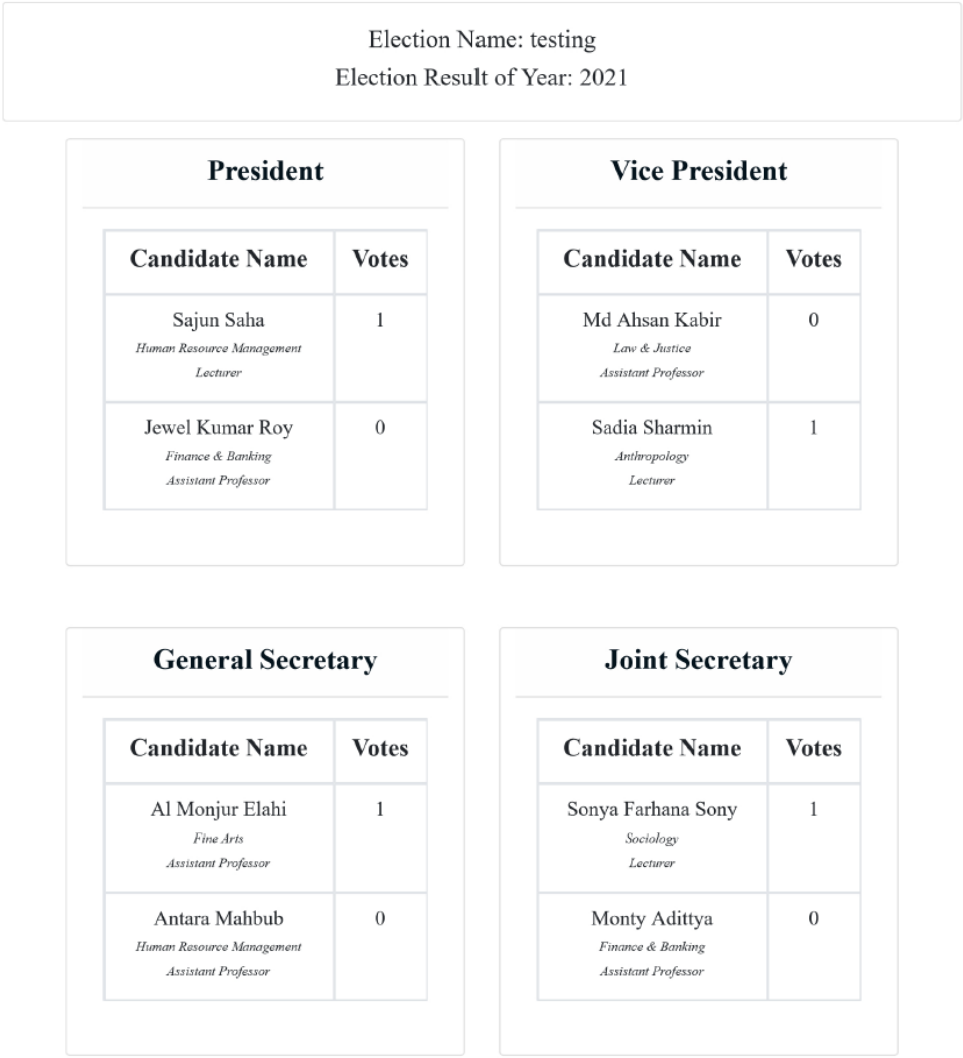


Figure 4.28: Ballot Paper PDF View

Figure 4.28 shows the PDF view of ballot paper.

Election Result PDF View



Election Name: testing
Election Result of Year: 2021

President

Candidate Name	Votes
Sajun Saha *Human Resource Management* *Lecturer*	1
Jewel Kumar Roy *Finance & Banking* *Assistant Professor*	0

Vice President

Candidate Name	Votes
Md Ahsan Kabir *Law & Justice* *Assistant Professor*	0
Sadia Sharmin *Anthropology* *Lecturer*	1

General Secretary

Candidate Name	Votes
Al Monjur Elahi *Fine Arts* *Assistant Professor*	1
Antara Mahbub *Human Resource Management* *Assistant Professor*	0

Joint Secretary

Candidate Name	Votes
Sonya Farhana Sony *Sociology* *Lecturer*	1
Monty Adittya *Finance & Banking* *Assistant Professor*	0

Figure 4.29: Election Result PDF View

Figure 4.29 shows the PDF view of election result.

4.2.1.2 User View

Voting ID and Link in Mail Box

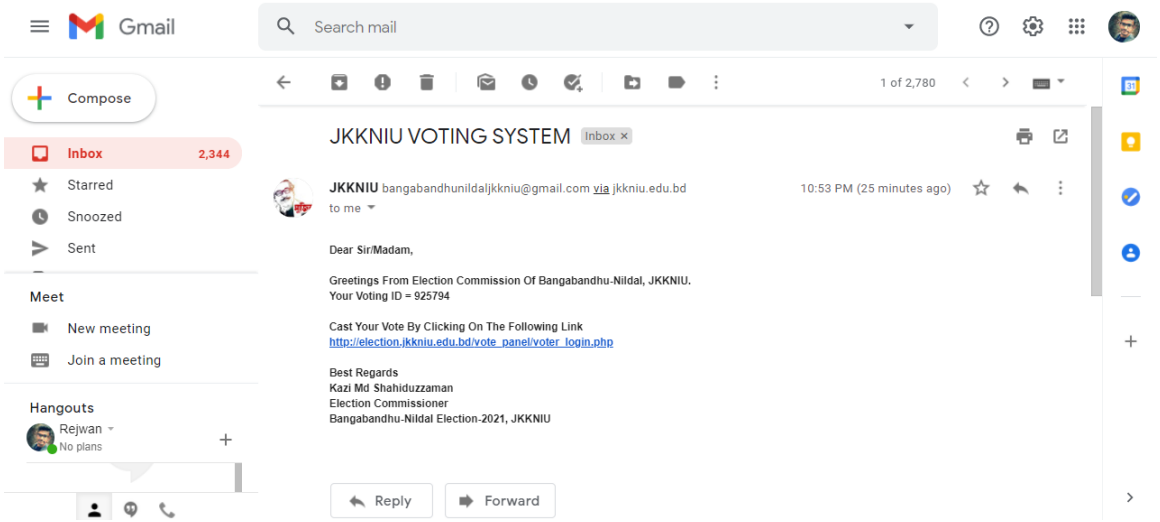


Figure 4.30: Voting ID and Link in Mailbox

Figure 4.30 shows that in the mailbox there is a message from the admin where there is an ID and a link. By clicking on the link the user will be redirected to the voting panel, and he/she can vote using the given ID.

Voter Login Page

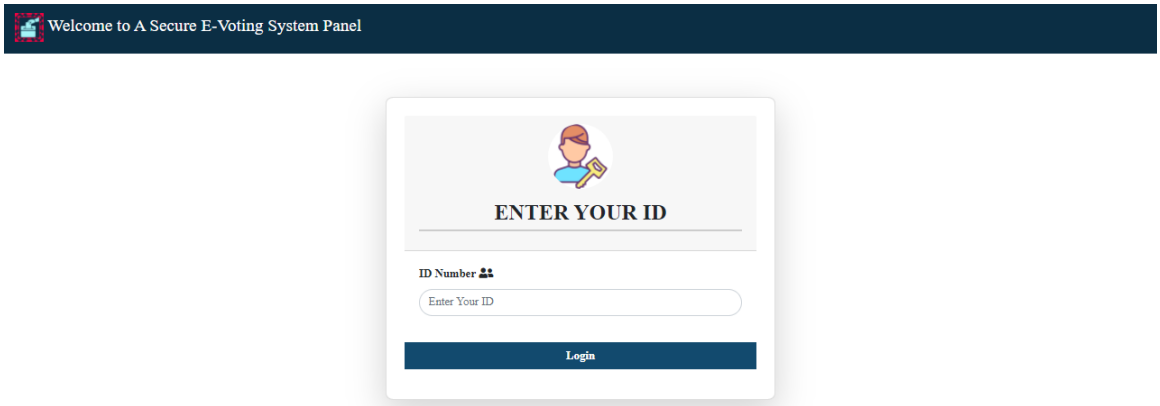
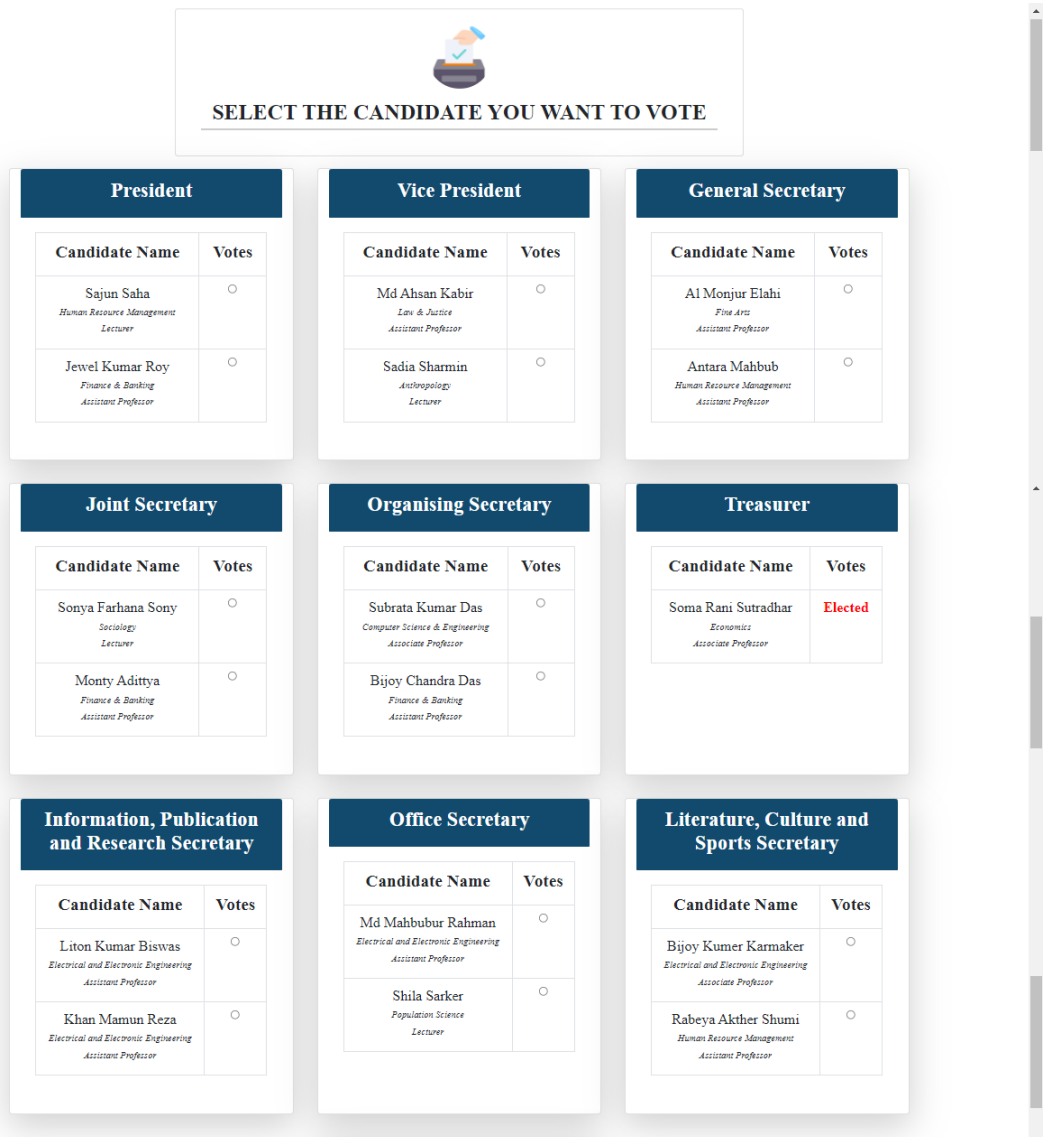


Figure 4.31: Voter Login Page

Figure 4.31 shows the login page of a voter. By using the given ID he/she can login and vote to his/her preferred candidates.

Vote Panel


SELECT THE CANDIDATE YOU WANT TO VOTE
President
Candidate Name
Votes
Sajun Saha
Human Resource Management
Lecturer
Jewel Kumar Roy
Finance & Banking
Assistant Professor
Vice President
Candidate Name
Votes
Md Ahsan Kabir
Law & Justice
Assistant Professor
Sadia Sharmin
Anthropology
Lecturer
General Secretary
Candidate Name
Votes
Al Monjur Elahi
Fine Arts
Assistant Professor
Antara Mahbub
Human Resource Management
Assistant Professor
Joint Secretary
Candidate Name
Votes
Sonya Farhana Sony
Sociology
Lecturer
Monty Adittya
Finance & Banking
Assistant Professor
Organising Secretary
Candidate Name
Votes
Subrata Kumar Das
Computer Science & Engineering
Associate Professor
Bijoy Chandra Das
Finance & Banking
Assistant Professor
Treasurer
Candidate Name
Votes
Soma Rani Sutradhar
Economics
Associate Professor
Elected
Information, Publication and Research Secretary
Candidate Name
Votes
Liton Kumar Biswas
Electrical and Electronic Engineering
Assistant Professor
Khan Mamun Reza
Electrical and Electronic Engineering
Assistant Professor
Office Secretary
Candidate Name
Votes
Md Mahbubur Rahman
Electrical and Electronic Engineering
Assistant Professor
Shila Sarker
Population Science
Lecturer
Literature, Culture and Sports Secretary
Candidate Name
Votes
Bijoy Kumer Karmaker
Electrical and Electronic Engineering
Associate Professor
Rabeya Akther Shumi
Human Resource Management
Assistant Professor

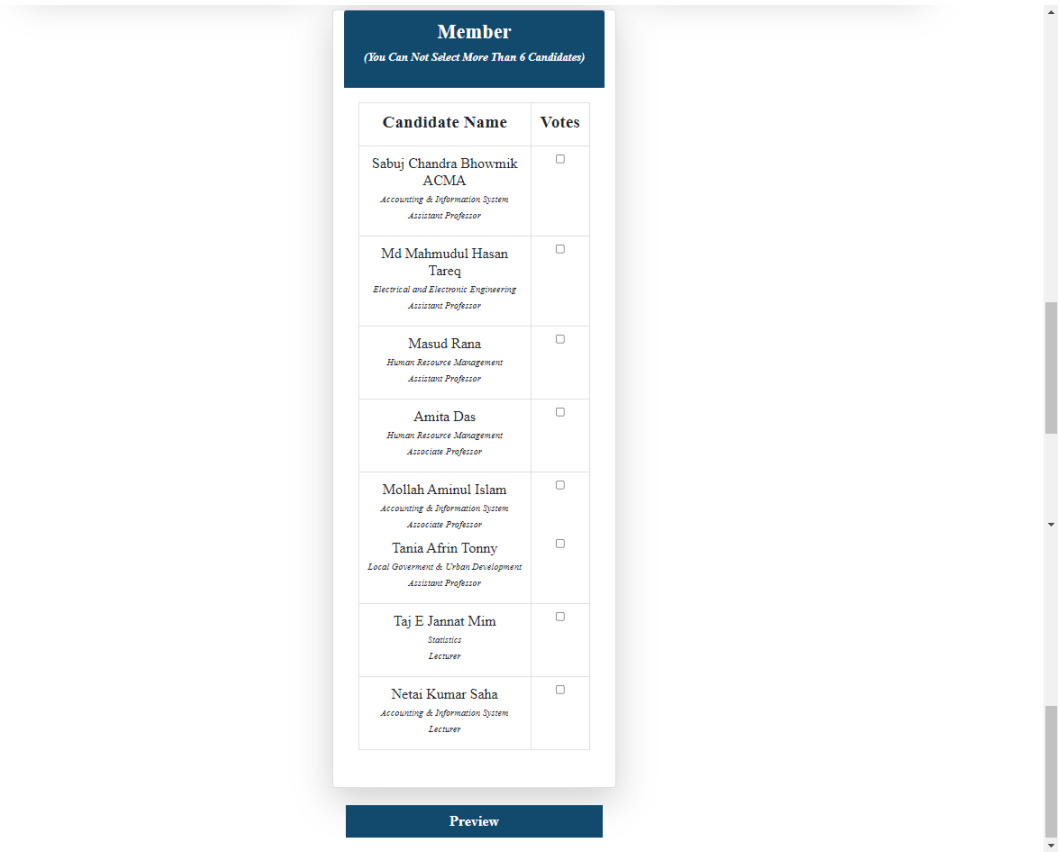


Figure 4.32: Vote Panel

Figure 4.32 shows the page where a user can vote to his/her preferred candidates.

Vote Preview

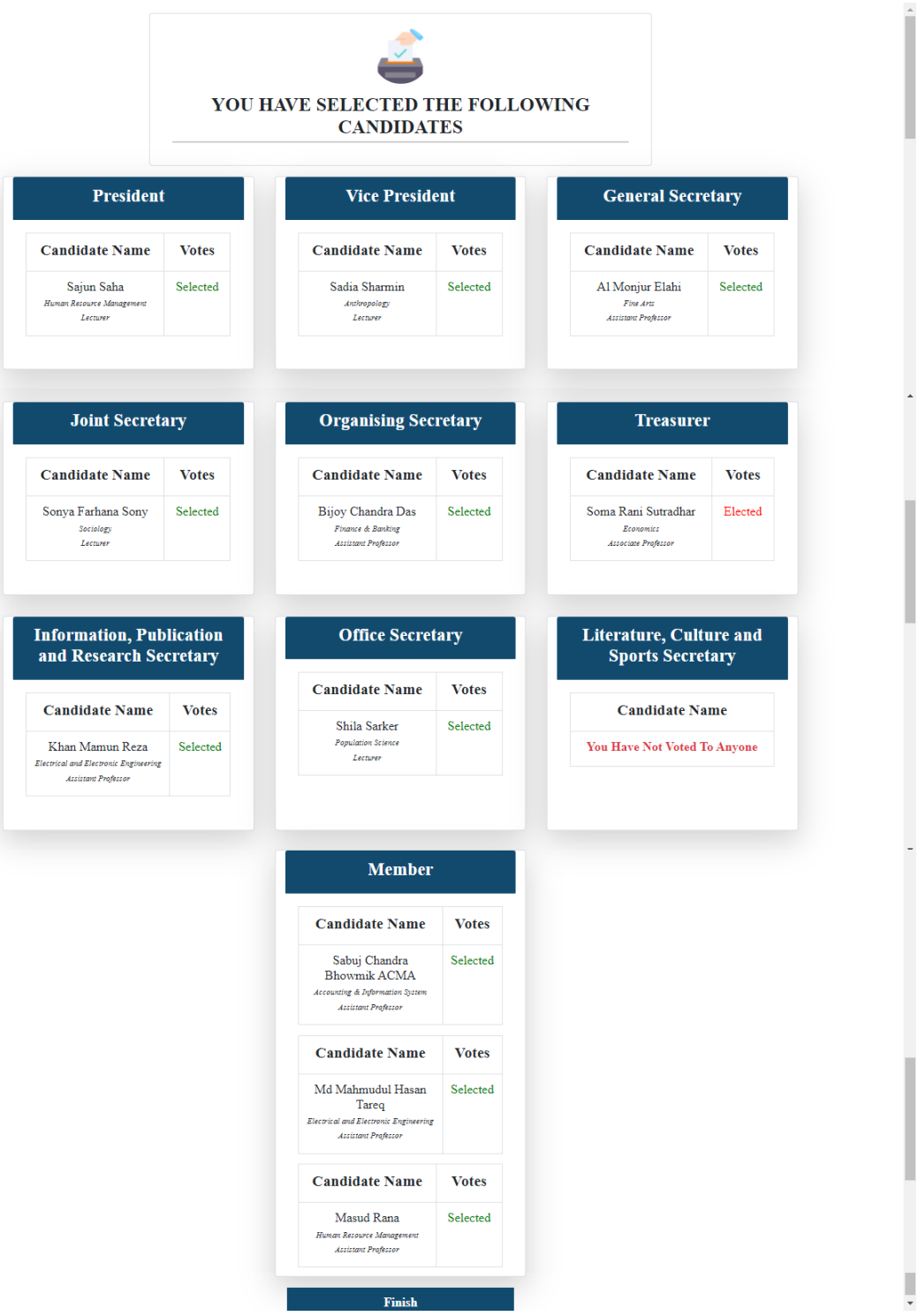


Figure 4.33: Vote Preview

Figure 4.33 shows the preview page to check whether a voter has voted to his/her preferred candidates or not.

Confirmation Message

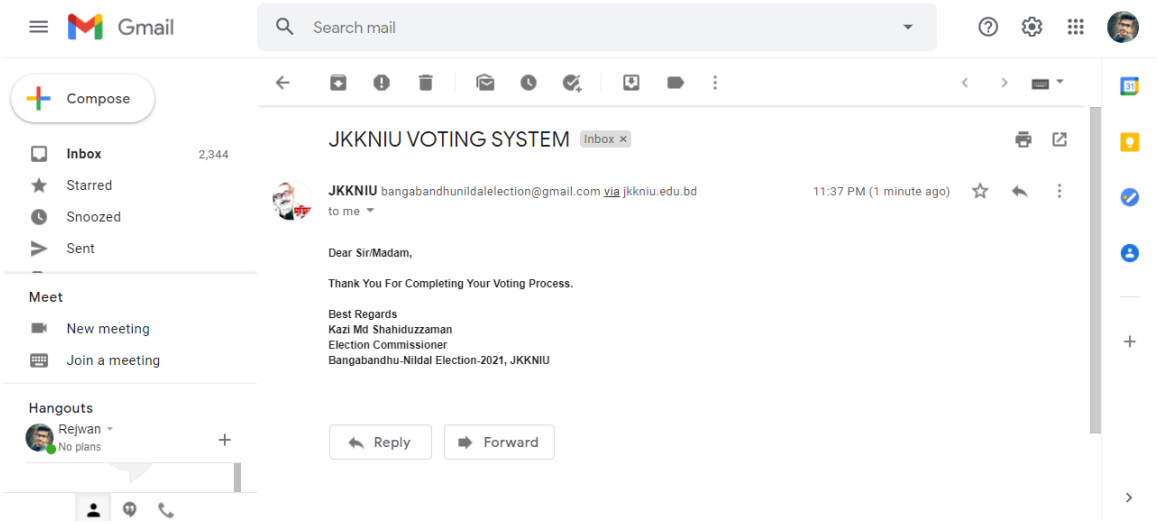


Figure 4.34: Confirmation Message

Figure 4.34 shows the page of confirmation message that a voter has successfully completed his voting process.

4.2.2 E-R Diagram of the developed system database

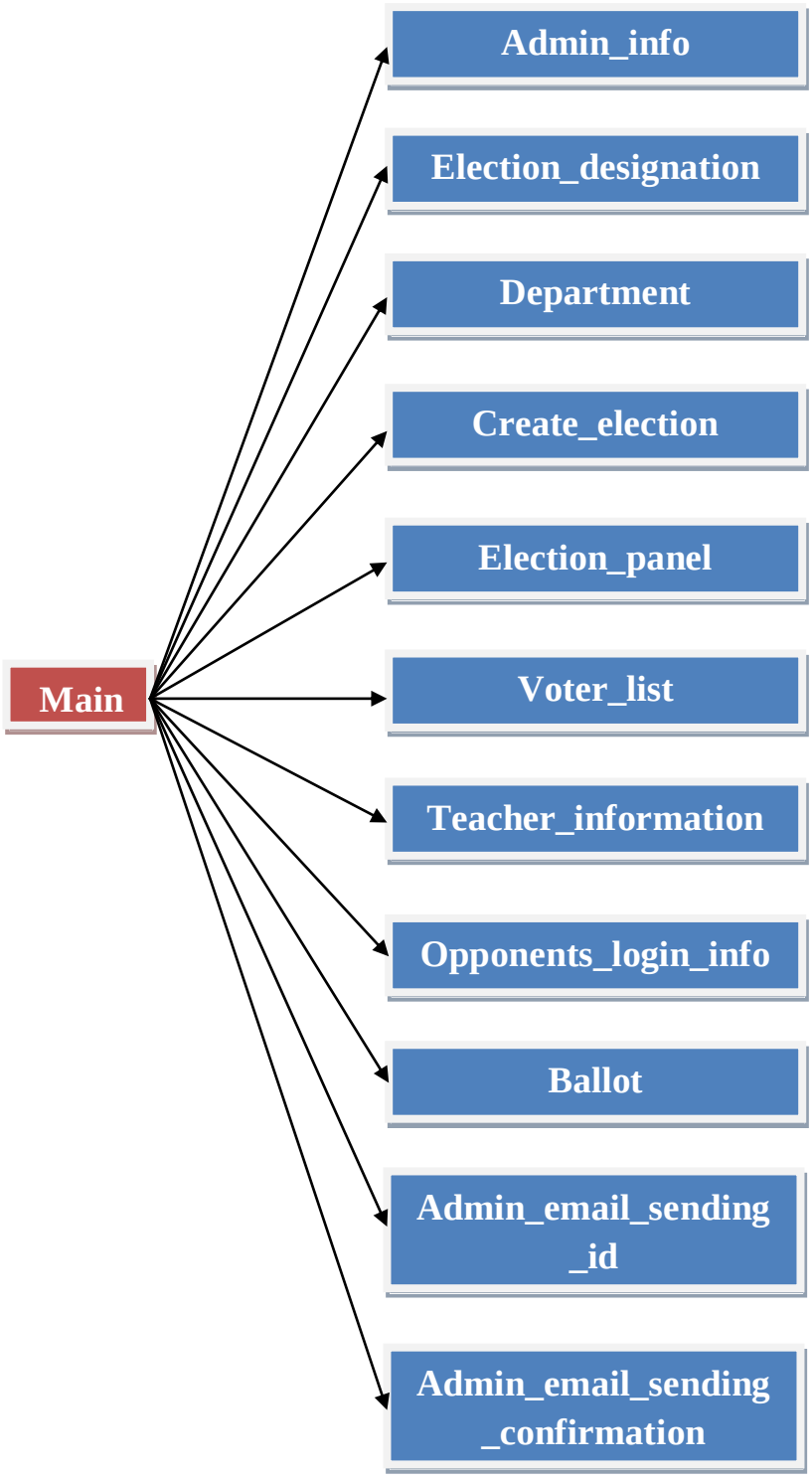


Figure 4.35: Database Main Node

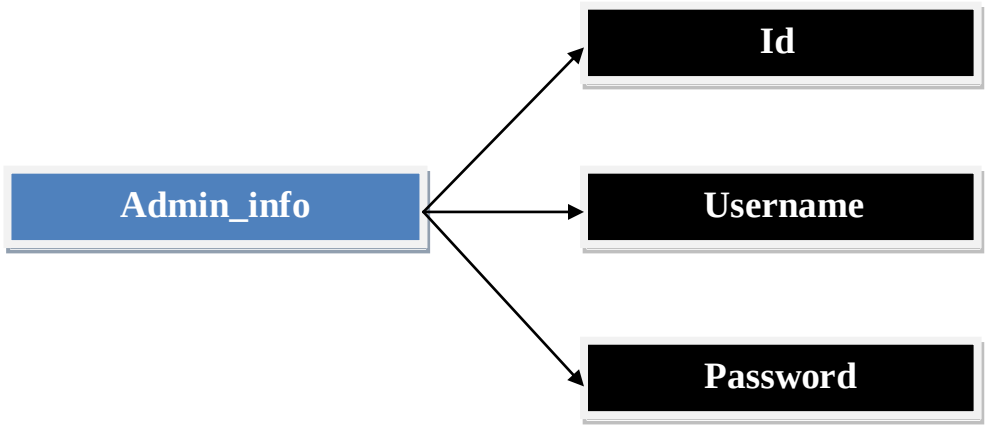


Figure 4.36: Admin_info Structure

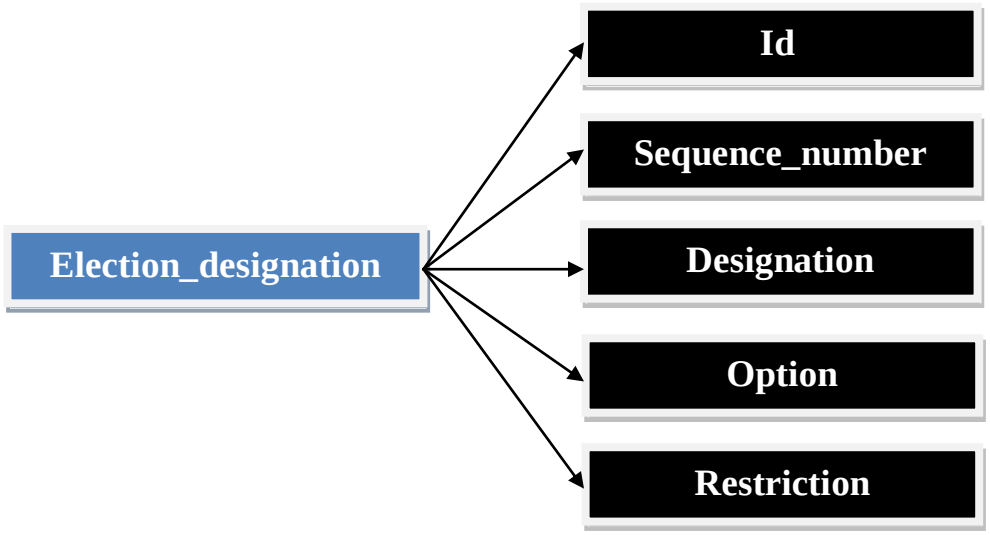


Figure 4.37: Election_designation Structure

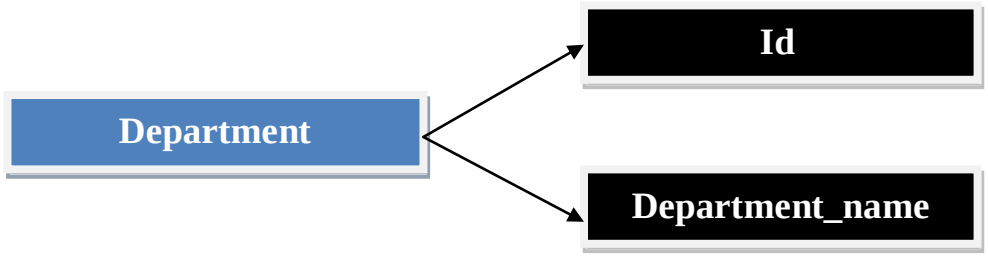


Figure 4.38: Department Structure

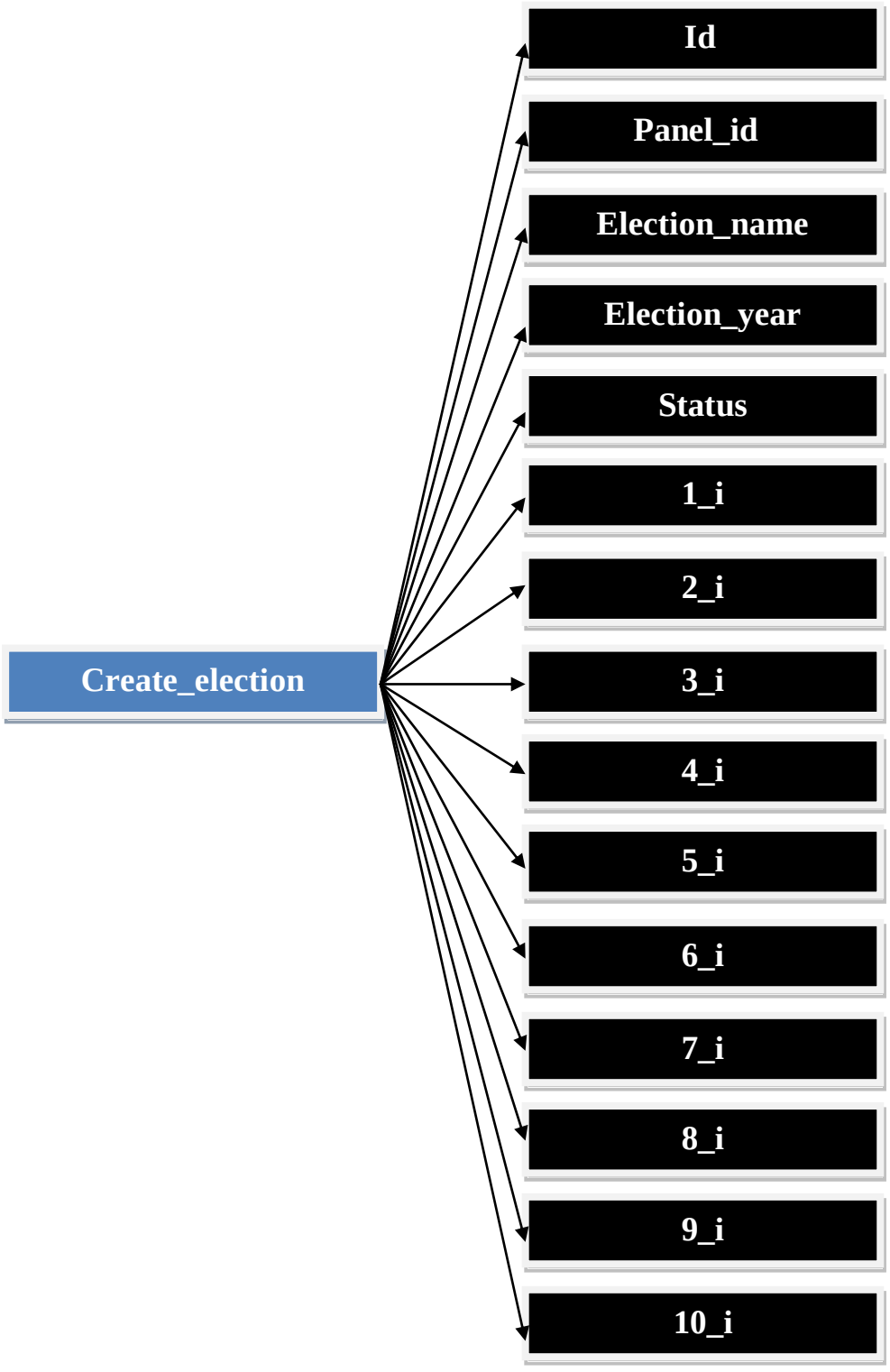


Figure 4.39: Create_election Structure

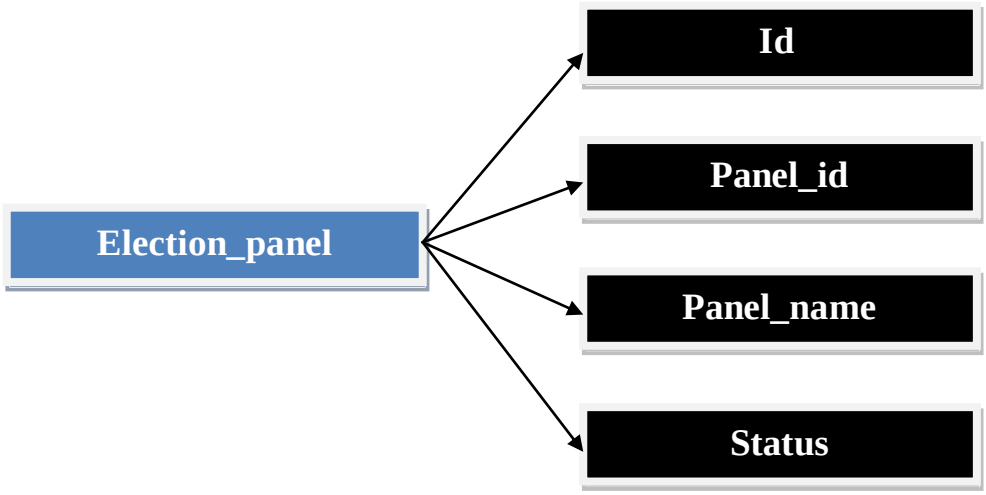


Figure 4.40: Election_panel Structure

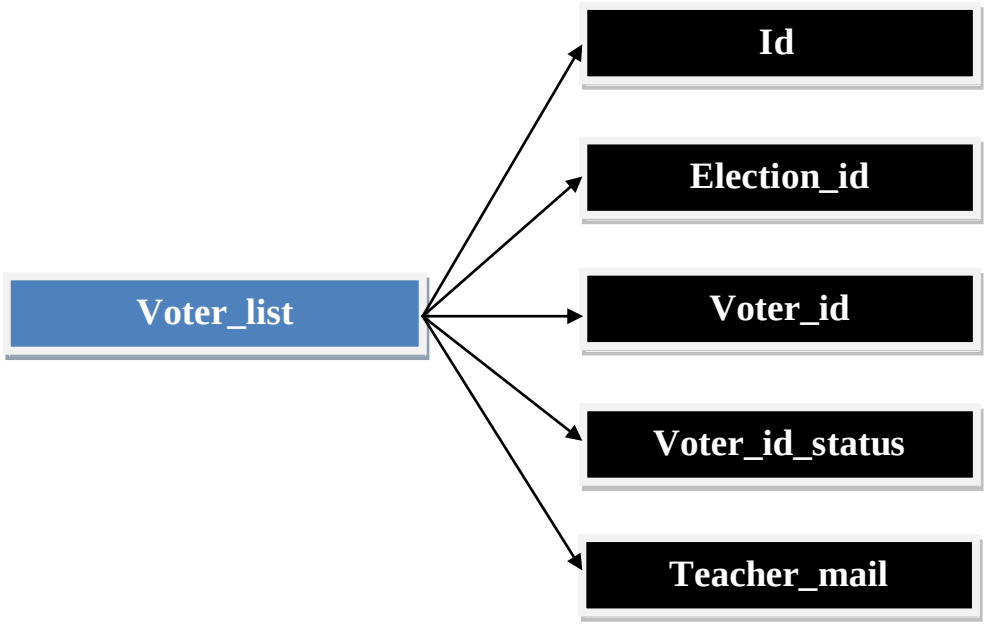


Figure 4.41: Voter_list Structure

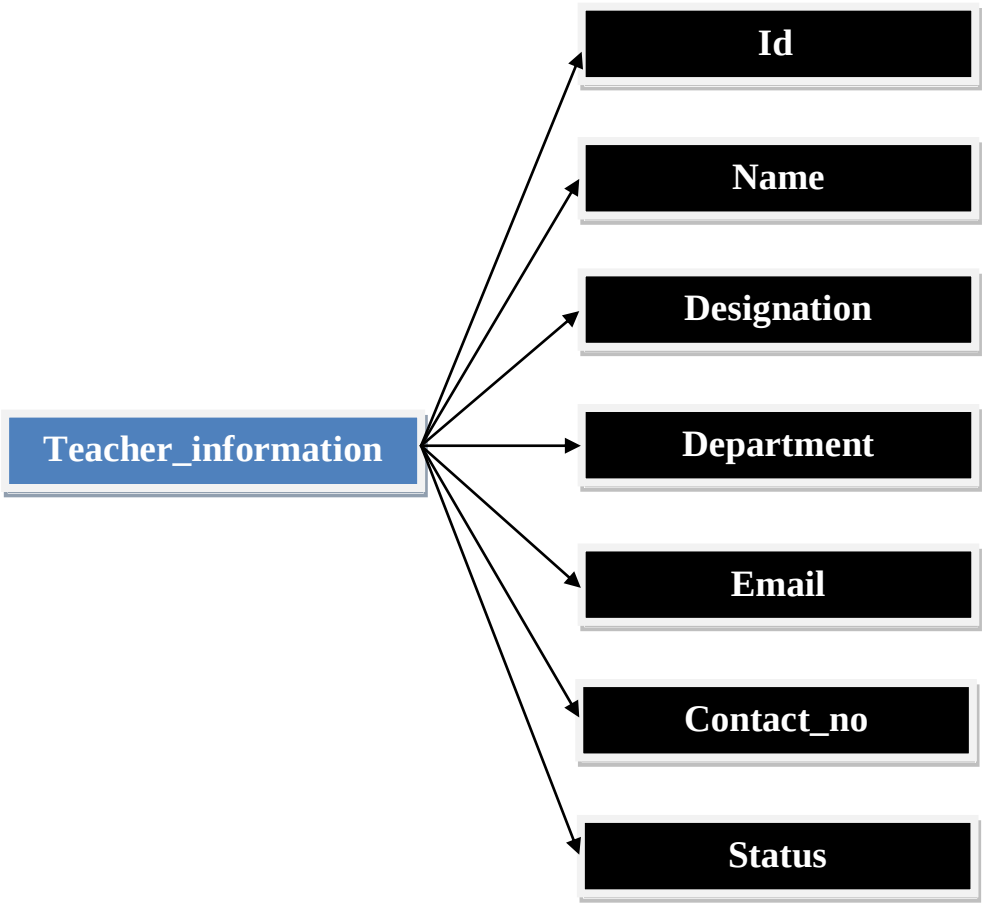


Figure 4.42: Teacher_information Structure

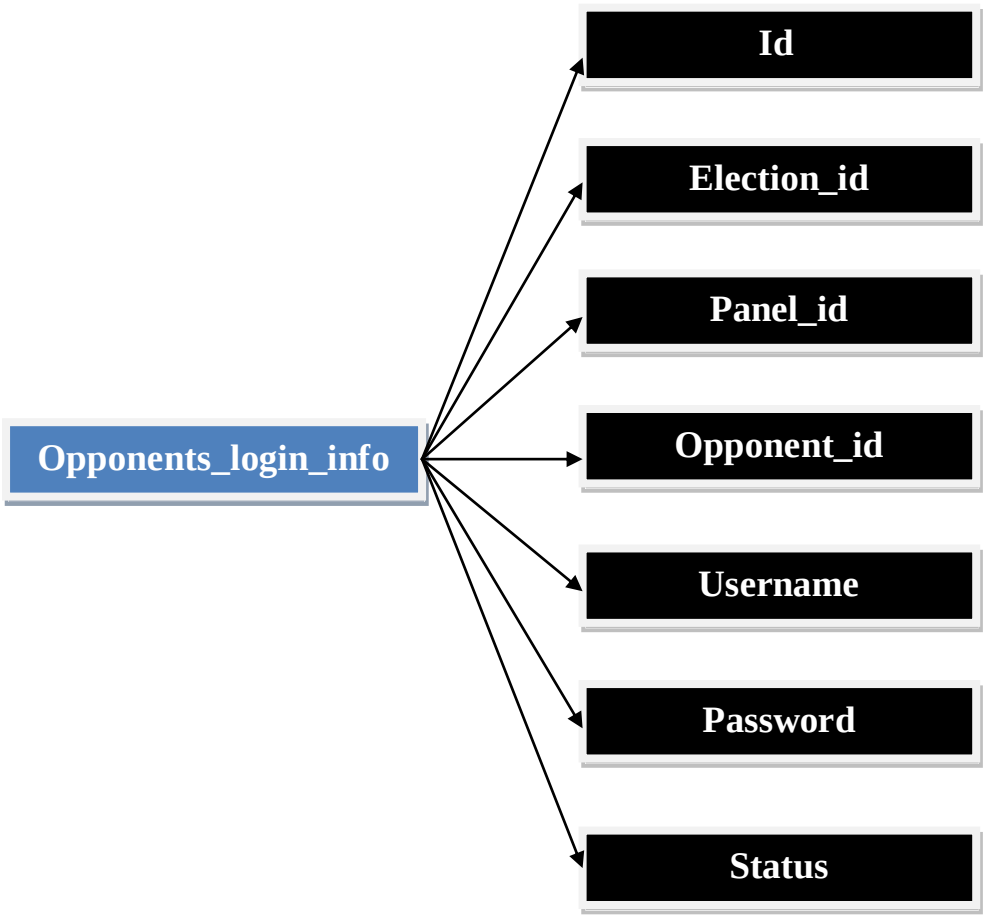


Figure 4.43: Opponents_login_info Structure

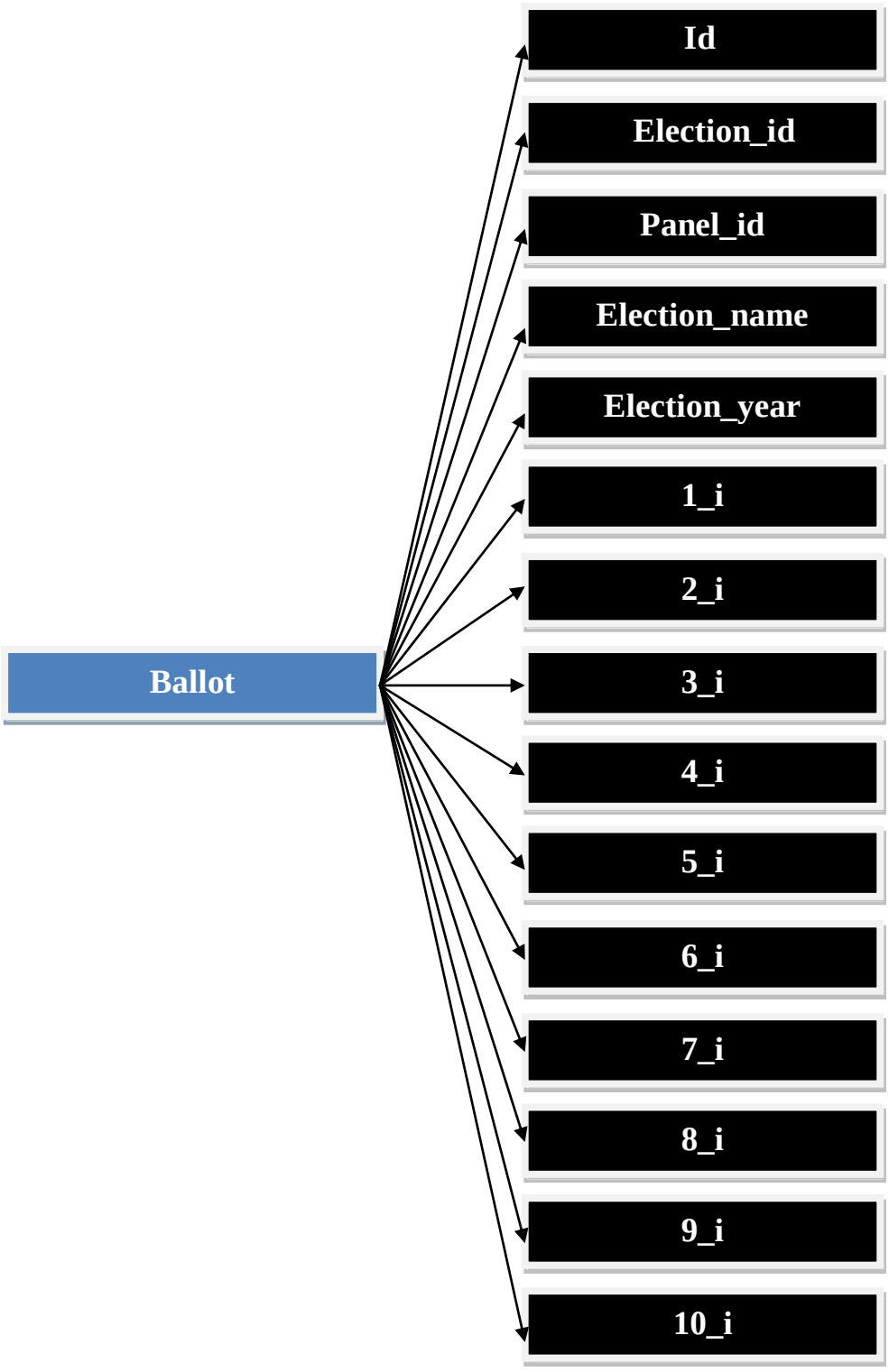


Figure 4.44: Ballot Structure

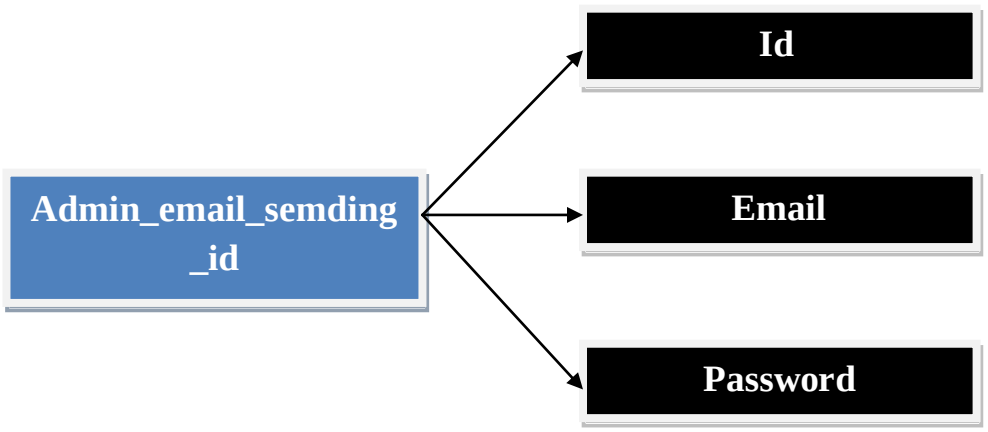


Figure 4.45: Admin_email_sending_id Structure

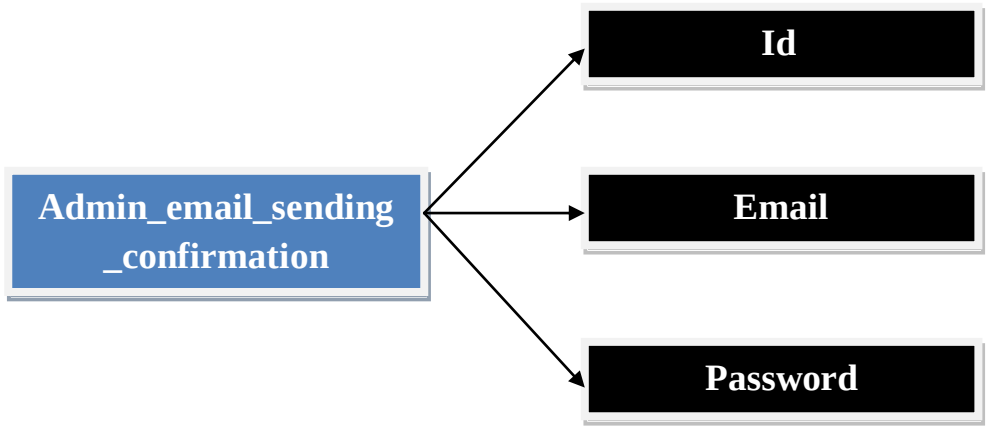


Figure 4.46: Admin_email_sending_confirmation Structure

Chapter-5

Software Testing

Testing is intended to show that a program does what it is intended to do and to discover program errors before it is put into use. When we test our system, we execute a program using artificial data. We check the results of the test run for errors, anomalies, or information about the programs non-functional attributes. The testing process has two distinct goals:

- To demonstrate to the developer and the customer that the software meets its requirements.
- To discover situations in which the behavior of the software is incorrect, undesirable, or does not conform to its specification.

5.1 Test Plan

A software test plan is a document describing the testing scope and activities. It is the basis for formally testing any software/product in a project [9]. It is a document which provides a central artifact to govern the planning and control of the test effort. It defines the general approach that will be employed to test the software and to evaluate the results of that testing, and is the top-level plan that will be used by stakeholders to govern and direct the detailed testing work.

5.1.1 Test Plan Types

One can have the following types of test plans:

- **Master Test Plan:** A single high-level test plan for a project/product that unifies all other test plans.
- **Testing Level Specific Test Plans:** Plans for each level of testing unit testing, module testing, sub-system testing, system testing etc.

5.2 Types of Testing

Here we just mentioned that the types of testing that we use in the project.

- **Unit Testing**

  In unit testing individual program units or object classes are tested. Here by using this testing we have focused on testing the functionality of methods of **"A Secure E-Voting System"** system.

- **Module Testing**

  The combination of unit program is called module. Here we tested the modules program have dependency such as all information are stored in the database and admin can find all information by their records.

- **Subsystem Testing**

  Then we combined some modules such as admin modules, user modules for the preliminary system testing in this project.

- **System Testing**

  It is the combination of two or more sub-system and then it is tested. Here we tested the entire system as per the requirements.

- **Acceptance Testing**

  Normally this type of testing is done to verify if system meets the customer specified requirements. After submitting the project to user then they tested it and to determine whether to accept application.

Chapter-6

Conclusion

In this report, we have discussed the development process of **"A Secure E-Voting System"**. After finishing the work, it could be said that our developed system is an efficient and easy system to organize and maintain manual voting process of an association. We have implemented a complete system and already used successfully for running two teachers' association elections at Jatiya Kabi Kazi Nazrul Islam University. However, we find some limitations which we will recover them in near future.

6.1 Limitations of the System

The system has the following limitations:

- There is no password recovery option for admin.
- Admin password can be recovered through a sign-up page that is not available in the system.

6.2 Future development of the System

The system has all the functionalities expected. Some important features that we want to add in further development of our project, these are pointed below:

- Interactive home page.
- Admin password recovery system.
- Enhancement of security.
- User interface.

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