TSHOGYEN

Project Report

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ROYAL UNIVERSITY OF BHUTAN GYALPOZHING
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CERTIFICATE

This is to certify that the BSc.IT. project report titled "TSHOGYEN", which is being submitted by Jamyang Lhashing (12190054), Rashmi Gurung (12190072), Sonam Cheda (12190076) and Sonam Dema (12190081), the students of Bachelors of Science in Information Technology, prepared during the academic year 2020-2021 in partial fulfilment of the requirement for the award of the degree of Bachelor of Science in Information Technology is a record of the students' work carried out at the Gyalpozhing College of Information Technology, Royal University of Bhutan, Gyalpozhing under my supervision and guidance.

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ACKNOWLEDGEMENT

First and foremost, we would like to express our special thanks to our project guide (Sir. Sumanta Bhattacharya) who guided us in doing this project with so much energy and sincere effort. Thank you sir for providing us with invaluable advice and different ideas in making this project unique. His constant suggestions, feedback, motivation and enthusiasm contributed tremendously to the successful completion of the project.

Then we would like to thank our two project coordinators, Miss. Jigme Wangmo and Miss. Tshering Lhamo for providing detailed information on how to carry out the project, marking schemes and datelines.

We would also like to earnestly acknowledge the sincere efforts and valuable time given by all sixteen panel members who gave us the golden opportunity to do this wonderful project on the topic (Tshogyen), which also helped us in doing a lot of Research which led us to know about so many new things. Their valuable guidance and feedback has helped us in improving and completing this project. We are really thankful to them.

At last but not in least, we would like to thank everyone who helped and motivated us to work on this project. Thank you so much.

ABSTRACT

Mobile Voting is the process of casting a vote with the help of a Mobile Application. “Tshogyen” is an online voting system developed for the selection of GCIT Councilors through a Mobile Application. The voting process of GCIT Councilors has always been a time consuming and tiresome process where the staff and students are required to stand in line for hours to cast a vote. To study the feasibility of this Mobile Voting Application in GCIT, a survey through a Google form was conducted which received many positive responses. The staff and students of GCIT liked the idea of voting using a Mobile Application as it would save time and save them from hardship. Tshogyen is an android application where the prototyping model was adopted as the methodology for designing the application and it is developed for making the GCIT Councilors’ voting an effective, efficient and error free process.

TERMINOLOGY

Term	Definition
Mobile Application	**A software program that runs on a mobile phone.**
Voting	**To give or register a vote.**
Paper Ballot	**A slip of paper used to register a vote.**
Electronic Voting Machines (EVMs)	**A mechanical device for recording and counting votes mechanically.**

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LIST OF ABBREVIATIONS

Sl.no	Term	Definition
1	GCIT	Gyalpozhing College of Information and Technology
2	RUB	Royal university of Bhutan
3	EVM	Electronic Voting Machine
4	ERD	Entity Relationship Diagram
5	JDK	Java Development Kit

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CHAPTER 1 INTRODUCTION

1.1 AIM

The aim of this project is to make GCIT Councilors' Voting procedure an effective, efficient and error free process.

1.2 MOTIVATION

Before the break out of COVID 19, GCIT Councilors' voting was done with the help of EVMs (Electronic Voting Machines) where both the staff and students had to stay in line for hours using up the class hours for the voting purpose. But during COVID 19 when large gatherings were not allowed, the college did the voting through online. The online voting was far more efficient and comfortable. This experience led to the idea of creating a GCIT Online Voting App for Councilors' selection.

1.3 OBJECTIVES

The objectives of this project are:

1. To build a Mobile Voting Application for the Councilors' selection of Gyalpozhing College of Information Technology.
2. To validate the system to ensure that only eligible voters (only staff and students of GCIT) are allowed to vote.
3. Error free counting of the votes.
4. No place restriction for voting.
5. Efficient voting process.

1.4 SCOPE

User profile: Usernames, voter IDs (student/employee ID), email and passwords will be used to identify the eligibility of the voters.

View: Only the members of GCIT will be able to view the candidates and their manifestos.

Vote: Only the members of GCIT will be allowed to vote. Once a vote is casted then it will be locked and no changes will be allowed.

Logout: The voters will be allowed to log out from the system anytime they desire.

1.5 LITERATURE REVIEW

Okuthe P Kogeda and *Nolunttu Mpekom* (September 2013), proposed the use of mobile phones as a time saving, cost effective and a secure method of casting a vote. They designed and developed a mobile phone voting system and conducted usability testing at the Central University of Technology (CUT). From the analyzed data, 99% of the participants were not comfortable with the current paper-based voting system because of the wastage of time as long hours were spent in queues waiting to vote and the blue colour painted on their fingers that remained for a long time after voting. On top of that, the registration process seemed to be the major problem for 20% of the participants. They complained that the registration icon was not known to them hence they had problems, but 80% of the participants managed to find the icon and registered without any problems. As soon as the participants were registered, everything after that was easy and enjoyable. The result of this usability testing proved and showed that the mobile voting system was reliable, time saving, secure and accessible as attested by the participants.

Urmil Bharti and her friends from Shaheed Rajguru College of Applied Sciences for Women, University of Delhi developed a mobile voting app titled “Adhikaar” to have a more efficient voting process, convenient to conduct the election and in order to manage elections in a better manner than that of traditional manual methods. The app was built as an interactive GUI for the voting system and the database was organized and maintained using Google Firebase platform which supports the app to be secure and scalable. The mobile app allows casting of votes from anywhere and anytime which makes the voting procedure efficient and comfortable. Adhikaar was tested in the departmental elections of Delhi College where the students were asked to install the app on Android mobile phones. For the better result and to evaluate the effectiveness of the app, some students casted votes from the college campus and some from outside or their home. Thus, at the end, the mobile voting application increased voting turnout %, improved overall security, reduced election expenses, saved time and manpower needed to conduct elections.

In a research article on the secure online voting system done by *Manjusha Vijay Amritkar* and others (November, 2016), this team explained this online voting system as an interactive voting application with which users can cast votes from any location and time with the help of their device. They proposed authentication techniques such as Face Detection, Recognition system and thumb impression scanning in online voting through mobile application to achieve the rules of the Supreme Electoral Council as follows: only eligible individuals are allowed to vote and one-man-one-vote. The votes are secret, and every vote gets counted in order to achieve the aims of online voting such as increasing voters' participation, lowering the expenses of running elections and improving the accuracy of results.

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 CURRENT STATE OF ART

Till this date (2021), in RUB Colleges in Bhutan including Gyalpozhing College of Information Technology, Mobile Application for the purpose of Councilors' voting has not been implemented. The voting in the colleges are done using paper ballots or Electronic Voting Machines (EVMs). As for the nomination of the candidates, students either volunteer for a post or the management selects the trust worthy candidates themself. The candidates declare their manifestos in the gatherings and voting is done either through the paper ballot or using EVMs.

Similarly, in Gyalpozhing College, the Councilors' selection is done following these exact procedures but due to the pandemic (COVID-19), for the consecutive two years, voting was conducted online with the help of Google sheet. Selection of the candidates were done similarly as before but the manifestos of the candidates which were in video format were uploaded in YouTube for the voters (staff and students of GCIT) to view. The actual voting was done through the Google sheet which greatly made the voting process efficient and easy.

Many different techniques have been followed for the GCIT Councilors' voting but not through a Mobile Application. "Tshogyen", a Mobile Application based on android device is developed for the purpose of GCIT Councilors' Voting. It focuses on making the voting process similar to that of online voting process implemented in GCIT which is through Google sheet but with extra features to make this app more user friendly, efficient and effective.

2.2 TECHNOLOGIES USED IN MOBILE APPLICATION DEVELOPMENT

The technologies used in mobile application development are as follows:

i. Laptop/Desktop

ii. Android smart phone as an emulator. iii. Fire store Database. iv. Android Studio Version 4.1.2.

CHAPTER 3 METHODOLOGY

3.1 METHODOLOGY OF THE STUDY

General Methodology:

For the development of the mobile voting application, “Tshogyen”, Prototype Model will be followed which involves the following key actions:

i. Problem Statement

The voting technique which is generally carried out in GCIT for the Councilors’ selection is through the use of EVMs. This method of voting consumes a lot of time, resources, energy of the voters and the people conducting the election and also involves a lot of manual work. Therefore, in order to deal with these problems, the mobile/online voting application, “Tshogyen” focus on the reduction of time, cost and human effort.

ii. Literature review

The detailed discussion of the comprehensive summaries of previously written research papers, articles, books and other sources relevant to mobile voting application will be carried out in this phase.

iii. Initial Communication

In this phase, we interact with the users/voters (staff and students of GCIT) and discuss the overall objectives of the application to be developed. The requirements gathering is carried out in this phase as well.

iv. Quick Design

In this phase, a quick design of the application is made according to the requirements gathered. Only the important aspects such as input and output formats are discussed. More focus is put into the aspects that will be visible to the users. This phase helps in the construction of a prototype.

v. Modeling Quick Design

In this phase, the prototype is developed and this prototype will help us to have a clear idea about the development of software and better understand the exact requirements.

vi. Construction of prototype

In this phase, the developed prototype will be provided to the customers for the detailed evaluation.

vii. Testing

In this phase, the constructed prototype will be tested for its functionalities. Unit testing, integrated testing, system testing and acceptance testing will be carried out. **viii. Deployment, delivery, feedback**

In this phase, if the users are not satisfied with the current prototype then it will be refined repeatedly until all the requirements of users are met. Then the final product is developed on the basis of the final prototype.

ix. Documentation

After complete development of the android application, the details of the project are compiled and documented.

The diagram below shows the general methodology followed for the development of this android application:

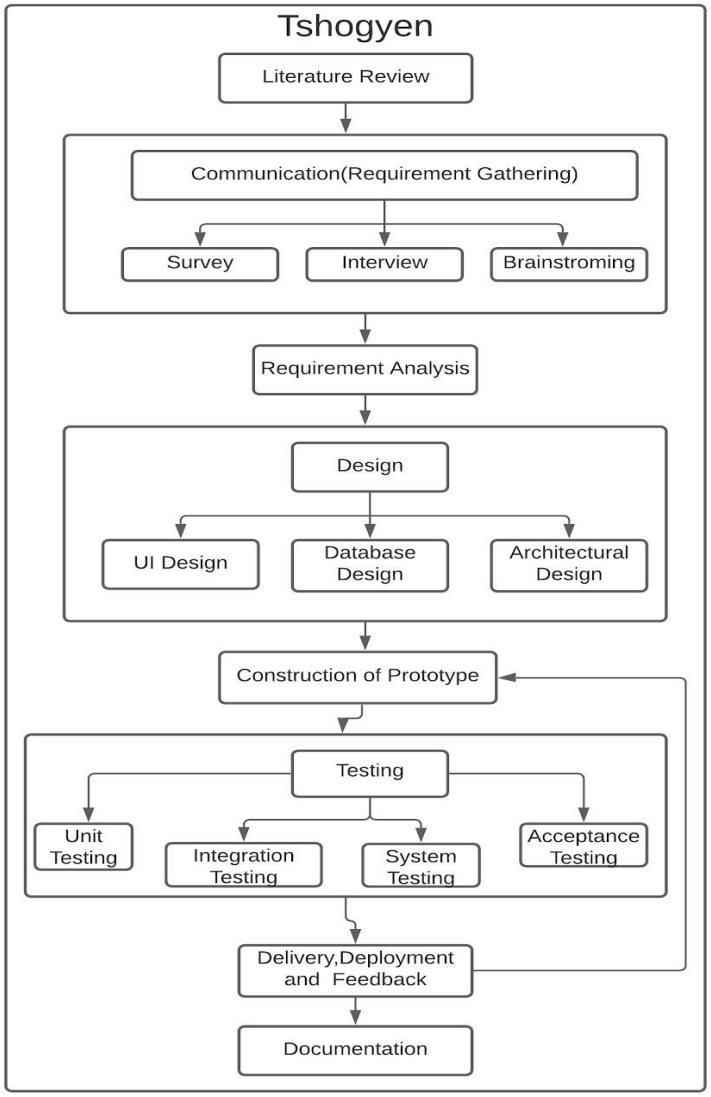

Figure 3.1: General methodology

Prototyping Mode

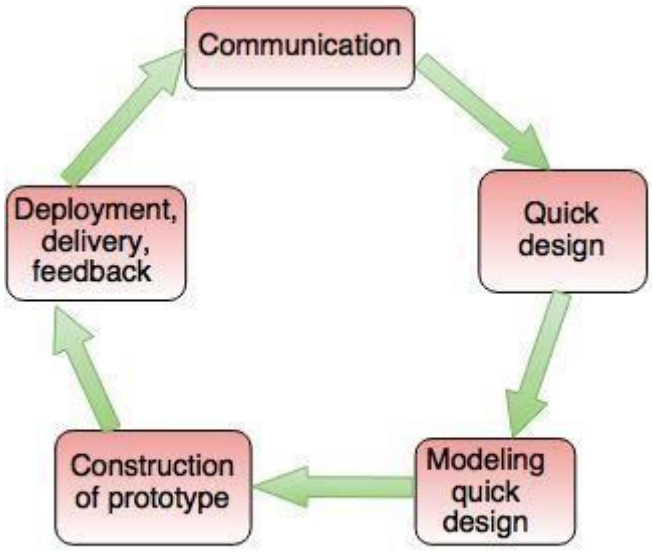

Fig. - The Prototyping Model

Figure 3.2: Prototyping Module

Followings are the reasons for selecting prototype model for the development of this application:

- Does not require to have knowledge of detailed input, output, processes, adaptability of operating system and full machine interaction.
- Active involvement of the users. The users will only be the people of GCIT which will make the interactions with the users much easier.
- Errors are identified and detected earlier.
- Fast feedback from the users which will help in solving the problems and bringing improvement in the software.
- Missing functionalities, confusing and difficult functions are easily detected.

Project Activities

Followings are the key activities that will be carried out in for the development of this mobile application:

1. Installation of software and tools: Installing Android Studio version (2 and above) and Java Development Kit (v8 or more).
2. Literature Review: Referring books, video tutorials, online reference related to android app development and research papers for the literature review.
3. Interacting with the users through surveys and interviews for the requirements gathering.
4. Design.
5. Second prototype : Login
6. Third prototype : User profile
7. Fourth prototype: Voting process.
8. Final prototype: Complete Application.
9. Final Testing
10. Documentation
11. Report Writing.

No.	*Elapsed time from start (in months) of the project*	*Milestone*	*Deliverables*
	-	*Commencement of the project*	

	9/02/2021- 13/02/2021	Guide and Topic Selection.	Selection of topic and guide is done.
	14/02/2021- 27/02/2021	Project proposal preparation (brainstorming,literature review,survey,etc).	Project proposal report and presentation
	28/02/2021- 04/03/2021	Requirement gathering	SRS document
	05/03/2021- 14/03/2021	Requirement analysis	Survey & Interview report, Usecase and ER diagram, Class diagram.
	15/03/2021- 20/03/2021	Designing of UI.	First Prototype(UI Design)
	21/03/2021- 01/04/2021	Login From	Second Prototype
	02/04/2021- 15/04/2021	User Profile	Third Prototype
	16/04/2021- 05/05/2021	Voting Process	Fourth Prototype
	06/05/2021- 14/05/2021	Final Testing.	Final Prototype.
	15/05/2021- 17/05/2021	Documentation	Final Application.
	18/05/2021- 22/05/2021	Project Report Writing.	Test Cases.
(Please add more rows if required.)			

Table 3.1: Project Activities

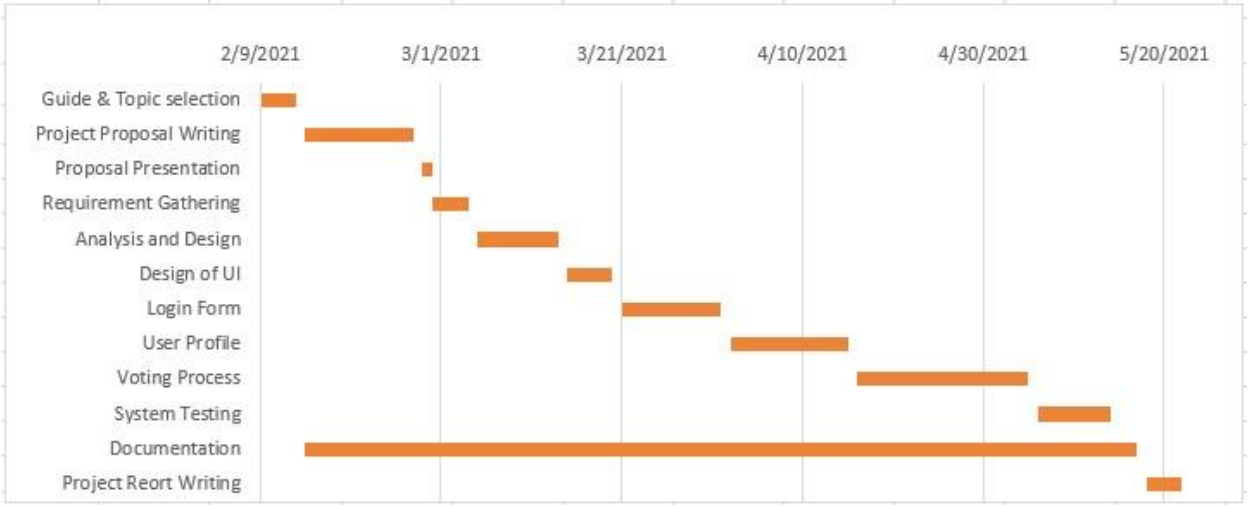

Figure 3.3: Gantt chart

The benefits of the Project are:

1. **Efficient voting process:** To vote, the staff and the students do not have to wait for hours. They can directly log in through the app, view the manifesto of the nominees and vote.
2. **Environmentally friendly voting:** Online voting system does not require many resources compared to paper based and EVM based voting.
3. **No restriction of time and place:** Online voting allows voting at anytime and anywhere. A college member will be able to vote even if they are out of the college campus.
4. **Avoid conflicts:** During paper based and EVM based voting, people have to wait in queue for their turn to vote. While standing in the queue, people may get influenced to vote for another candidate and sometimes this may create conflicts between the voters.
5. **Suited for the situations like COVID 19:** No large gathering is required, touching the equipment such as EVMs that are touched by many people can be avoided and do not have to deal with the malfunctioning of the equipment.

6. **Protect Integrity:** The integrity of individual vote is protected by preventing voters from being able to vote multiple times

CHAPTER 4 REQUIREMENT SPECIFICATION

4.1 FUNCTIONAL REQUIREMENT

For this Mobile Voting Application titled as "Tshogyen", the functional requirements are divided into two parts; a user/voter part and the admin part.

Admin: The functionalities / features in the admin part are as follows:

i. Login

As the admin is already pre-registered, the admin has to login using the email and password.

ii. Forgot password

If the admin forgets password to log into the application then the admin can use this feature to reset the password with the help of email.

iii. Show password

This feature is used in order to see if the right password is entered or not.

iv. Option Menu

In the option menu there are three options and they are as follows:

a. Admin Profile: The admin will be allowed to view their details such as name and email address. On top of that the admin has the option to change their password.

b. About: It is just a short description about the application.

c. Logout: An option to logout from the application.

v. Register Candidates

The admin has to register the candidates with the required details such as name, id (student/employee id), email address, post/role and a photo.

vi. View Candidates

In this feature the admin can perform the following five functionalities:

a. **View:** Viewing the candidates.

b. **Search:** Searching the candidates respective of their post/role.
c. **Add:** Adding/registering new candidates.
d. **Update:** Updating the details of the registered candidates
e. **Delete:** Deleting the candidates.

Voters: The functionalities / features in the voters' part are as follows: **i.**

Registration:

The users/voters (staff and students of GCIT) have to register with the help of their personal details such as name, id (student/employee id) and they have to set their password.

ii. Login

The users/voters after successful registration can log into the application using email and password.

iii. Forgot password

If the voters forget the password for logging into the application then the voters can use this feature to reset the password with the help of email.

iv. Show password

This feature is used in order to see if the right password is entered or not.

v. Option Menu

In the option menu there are three options and they are as follows:

a. **User Profile:** The voters will be allowed to view their details such as name, id and email address. On top of that the voters have the option to change their password.
b. **About:** It is just a short description about the application.
c. **Logout:** An option to logout from the application.

v**i. Candidates:** In this feature the users/voters can perform the following three functionalities:

a. **View:** Have the option to view the candidates.
b. **Search:** Have the option to search for the candidates respective of their role/post.

c. **Manifesto:** Have the option to view the manifesto of the candidates.

When clicked on a card of each candidate, the voters will be redirected to a YouTube channel where all the manifestos of each candidate are posted.

vii. Vote

The voters after viewing the manifestos of the candidates can cast a vote. The vote will be counted once clicked on the vote button and the rest of the buttons also become disabled.

Viii. Result

After the voting process is done then the voters can view the result of the students.

4.2 NON-FUNCTIONAL REQUIREMENT

Portability

As this application is meant to run on android mobile devices, it is a fact that android devices are more portable than laptops and desktops.

Usability

This mobile voting application will be user friendly. Both of the users; voters and admin will be familiar with the user interface easily of this application. Availability of the options such as view, update and delete options makes this application more effective and user friendly.

Reliability

This mobile voting application will provide reliable and realistic information about the election and its candidates. The result will be declared without any errors of duplicate votes.

Availability

This application will run irrespective of date, time and place; application will be available for 24/7.

Supportability

The application will be responsive and it will run on any device that has Online/internet connectivity. And this mobile application will run on multiple android devices irrespective of size.

4.3 SOFTWARE REQUIREMENT

The software requirements of this application are as follows:

i. Android studio version 4.1.2 ii.

JDK 15 (Java Development Kit)

iii. Firebase:

a. Fire Store Database

b. Fire Storage (For storing images)

c. Authentication (For email authentication)

4.4 HARDWARE REQUIREMENT

The hardware requirements for the developers of this application are as follows:

i. Laptop/Desktop (Microsoft Windows 7/8/10 (64 bits) / Linux/mac)

ii. Ram of minimum 4 GB iii. Processor 2.00GHz*4 iv. Android phone as an emulator

The hardware requirements for the voters/users of this application is as follows:

i. Android phone

CHAPTER 5 SOLUTION AND IMPLEMENTATION

5.1 INTERFACE DESIGN

After the completion of the requirement gathering, the interface design of this mobile voting application was made/designed using an online prototype designing website titled as, “proto.io”.

Two interface design was made; one for admin and the other for the voters (students and staff of GCIT).

5.1.1 ADMIN INTERFACE DESIGN

i. Admin Login

The launcher page of this Mobile Voting Application will be the login page. Both the admin and the voters will have the same login page. Admin will not be required to register as he/she will be already pre-registered. Admin login page requires the email address and the password in order to log into the application. All the validation for the login page such as the right email address validation and the correct password validation will be taken into consideration seriously. The admin has to enter the right login inputs to log into the app but if the entered inputs does not match with the pre-registered data then the admin will not be able to log into the application. Clicking the ‘Login’ button after entering the valid credentials will redirect the admin to home page of the admin dashboard.

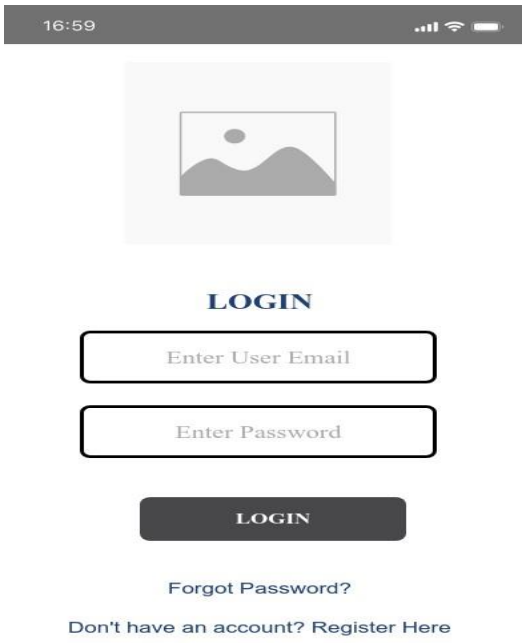

Figure 5.1: Admin Login

ii. Home Page of Admin Dashboard

After the successful login, the admin will be redirected to the home page of the admin dashboard which contains an image slider and two buttons; candidate registration button and view candidate button.

Figure 5.2: Admin Homepage

A. Candidate registration button

Clicking this button will redirect to the candidate registration page. The candidates are registered by the admin with the required credentials such as photo, name, email, student id and the role/post they are selected for has volunteered for. In order to successfully register the candidates, the admin has to fill all the text fields with the correct data. After entering all the right credentials and clicking/tabbing on the 'Register' button, the candidates will be registered in the database (Fire Store).

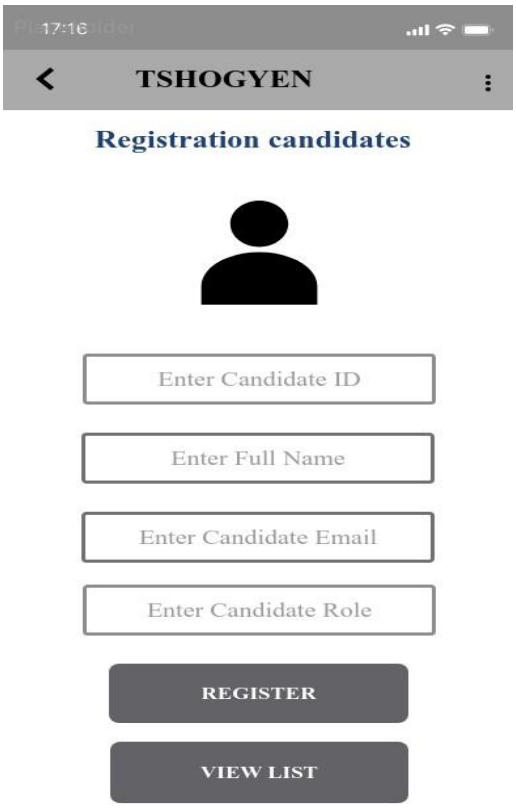

Figure 5.3: Candidate Registrations

B. View Candidates button

Clicking this button will redirect to another page where the admin will be able to perform the following five functions: a. View

Clicking the view candidates button will redirect to a page where all the registered candidates will be listed/displayed with all the registered information such as the candidate image, name, user id and the role. b. Add

Clicking the plus sign placed at the right below corner of the page will redirect to the candidate registration page where the admin can register the unregistered candidates.

c. Update

Holding a card view of a specific candidate for 2 seconds will pop up a dialog box which contains the update and the delete options. When clicking

the update button will redirect to the update page. Then the admin can update the information of the candidates.

d. Delete

Holding a card view of a specific candidate for 2 seconds will pop up a dialog box which contains the update and the delete options. When clicking the delete button will again pop up a dialog box stating the delete and cancel option. Clicking on the cancel button will not delete the candidate but the if the delete option is clicked then the specific candidate will be deleted from the database permanently.

e. Search

At the top of the view candidate page contains the search bar. The admin can search for the registered candidates respective of their role/post. Entering a particular role/post in this search bar will list/ display only the candidates of this role/post.

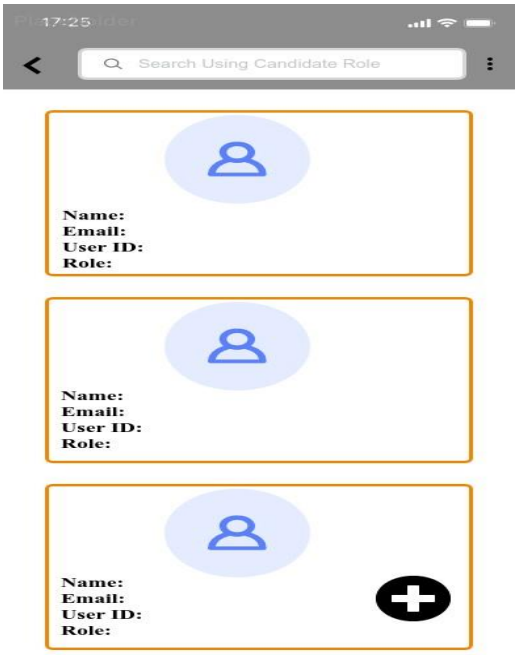

Figure 5.4: View Candidates

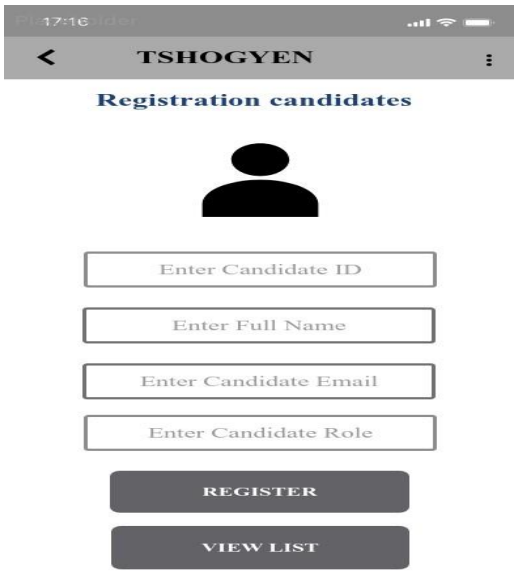

Figure 5.5: Add Candidates

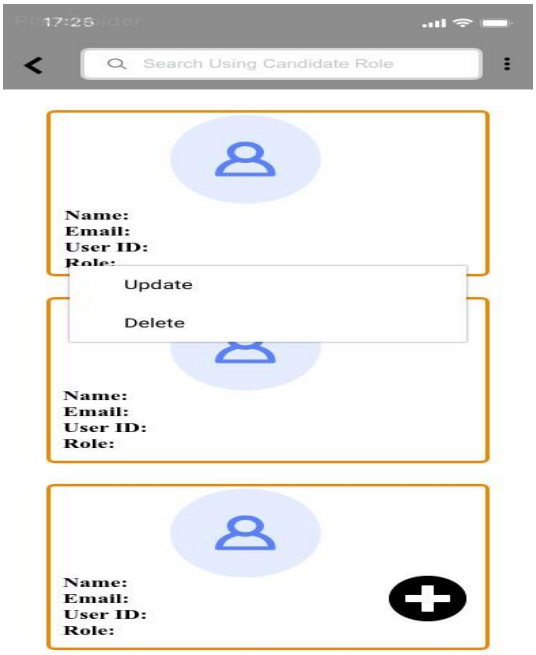

Figure 5.6: Update Candidates

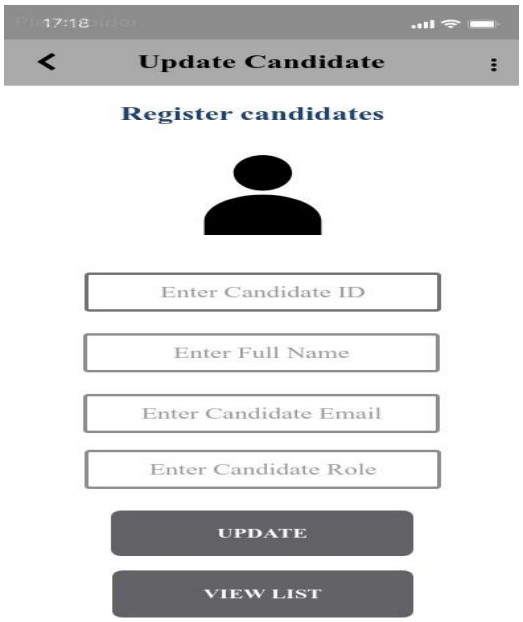

Figure 5.7: Update Candidates Details

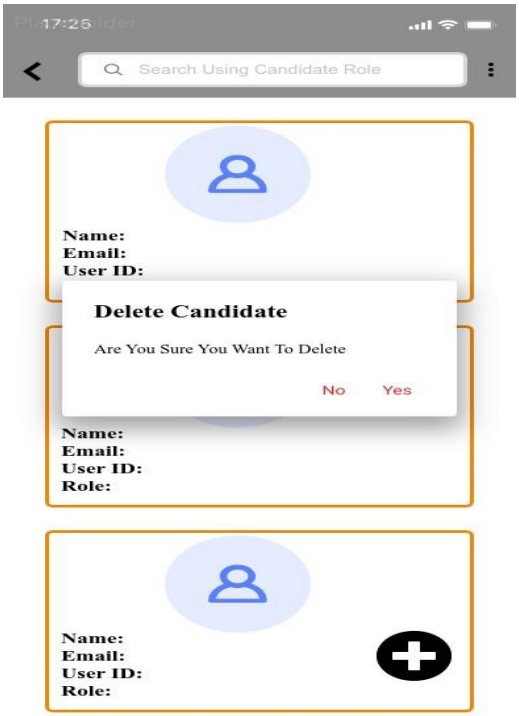

Figure 5.8: Delete Candidates

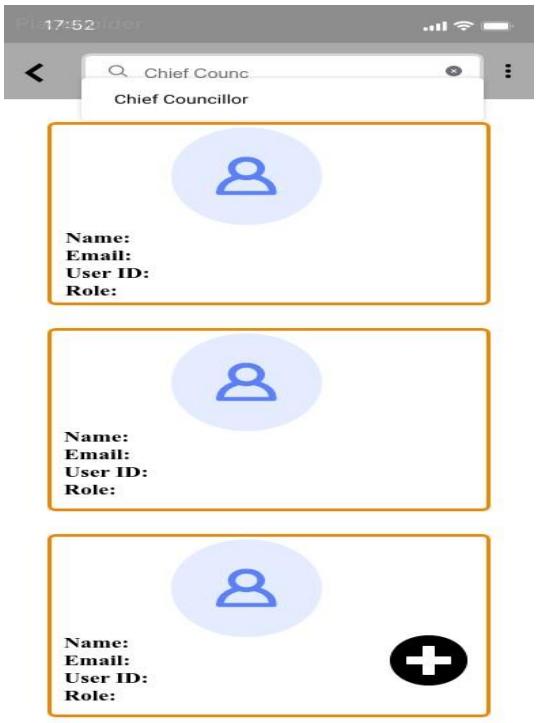

Figure 5.9: Search Candidates

iii. Option Menu

Clicking the icon of the option menu placed at the app bar will display the options of this option menu which will contain the following options:

A. Admin Profile

When clicking on this option will redirect to the admin profile page where the details of the admin is displayed. This page also has the option to update/reset the password. Admin can reset his/her password.

B. About

When clicking on this option will redirected to a new page which will contain a small description of this mobile voting application along with the logo of this application.

C. Logout

Admin has the option to logout of the application when not in need or use.

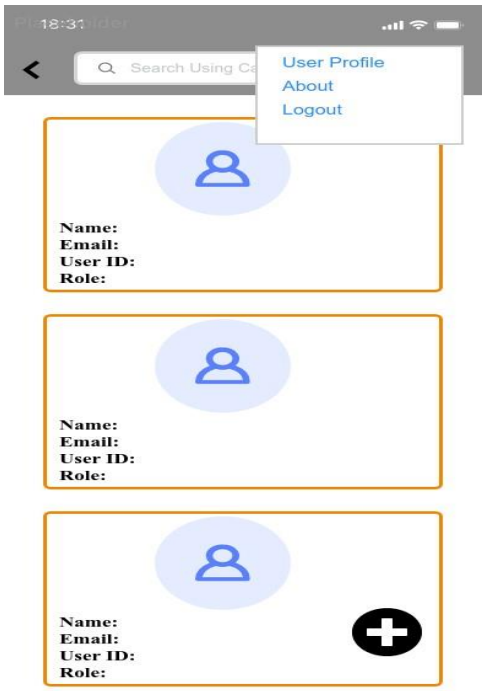

Figure 5.11: Admin Options Menu

Figure 5.11: Admin Profile

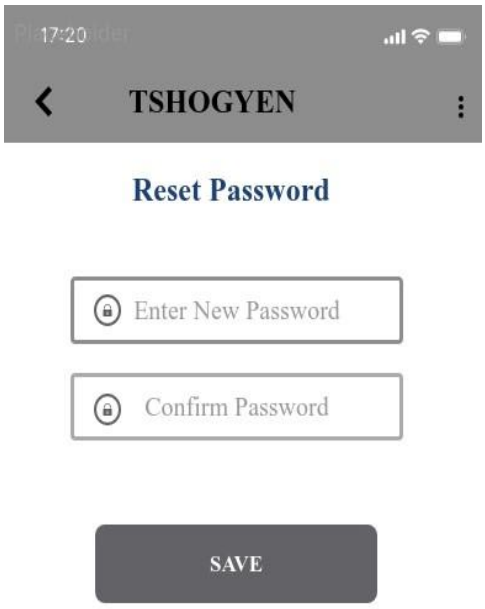

Figure 5.12: Admin Reset Password

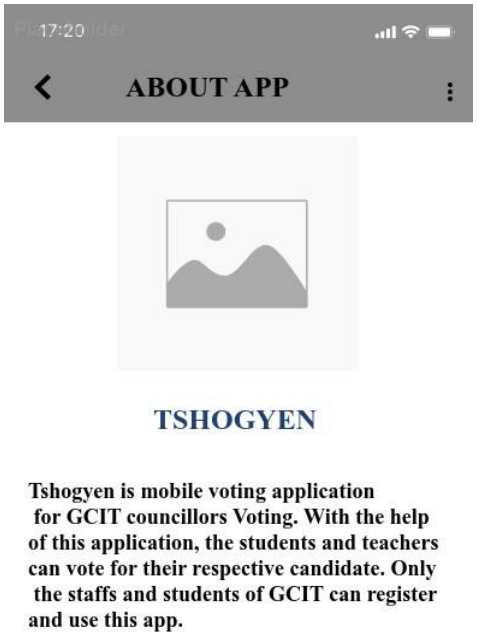

Figure 5.13: About

5.1.2 VOTERS INTERFACE DESIGN

In the voter/user dashboard, it contains the following functionalities as follows:

i. Voter Registration

Unlike admin, the voters are not pre-registered and therefore they have to register first in order to log into the system. The launcher page of the voter dashboard is also the login page and therefore the voter will be redirected to the login page when opening this application. If the voter has not registered then they can click on the option 'Register' and they will be redirected to the voter registration page. The voters will be required to register with some specific data such as name, id (student/ employee id), email, password and a confirm password. All the necessary validation will be applied such as only text will be accepted for the name field, only text and digits will be accepted in the id field, only the emails with the GCIT format (abc123.gcit@rub.edu.bt) will be accepted, the password has to be equal or more than six digits and the inputs of confirm password field has to match the inputs of password field. Then after clicking the 'Register' button, the voters will be registered successful

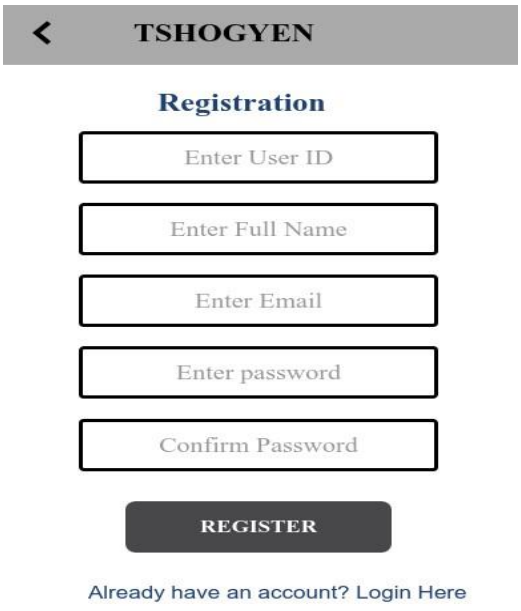

Figure 5.14: Voter Registration

ii. Voter Login

After the successful registration of the voters, the voters will be able to log into the application with the required details such as name and email. The details entered in the

login page has to match one of the data stored in the database and then only will the voters be able to log into the application successfully. All the validation for the login page such as the right email address validation and the correct password validation will be taken into consideration seriously. Clicking the 'Login' button after entering the valid credentials will redirect the voters to the home page of the user dashboard.

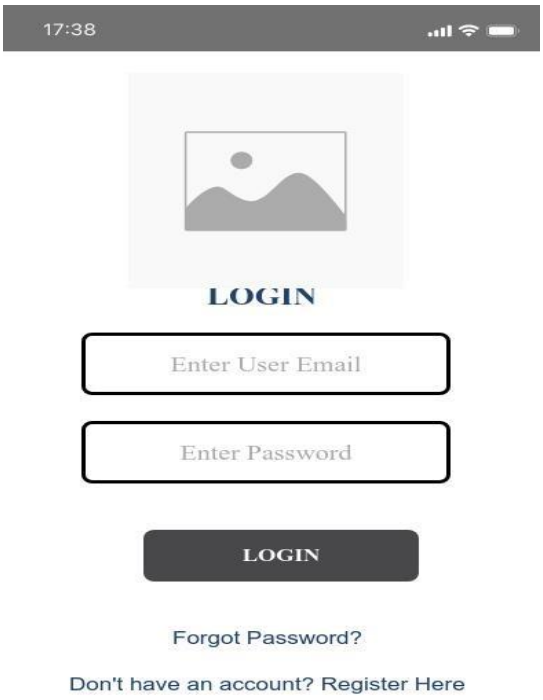

Figure 5.15: Voter Login

iii. Home page of User Dashboard

After the successful login, the voters will be redirected to the home page of the user dashboard which contains an image slider and three buttons; candidate button, vote button and the result button.

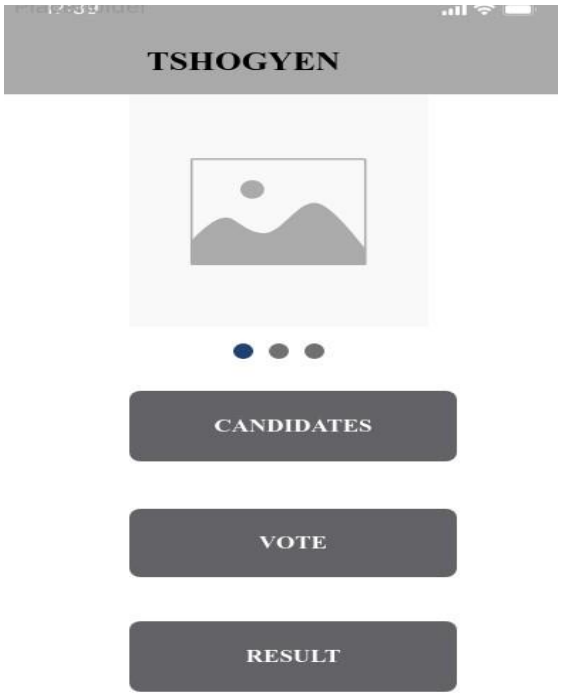

Figure 5.16: User Homepage

A. Candidate Button

Clicking this candidate button in the user dashboard will redirect the voters to another page where the voters will be able to perform the following three functionalities: a. View

Right after clicking the candidate button the voters will be redirected to a page where all the registered candidates will be displayed. The candidate details such as their name, student id and role/post along with their photo will be displayed. b. Search

The search bar located at the top of the page will help make the viewing of the candidates' process an easy task as the voters will be required to just enter a role/post and all the candidates for that role will be displayed.

c. Manifesto

When clicking one of the card view of a specific candidate will redirect the voters to a YouTube page where the manifestos of all the registered candidates

which are in the video format are uploaded. This enables the voter to view the manifestos in a convenient way.

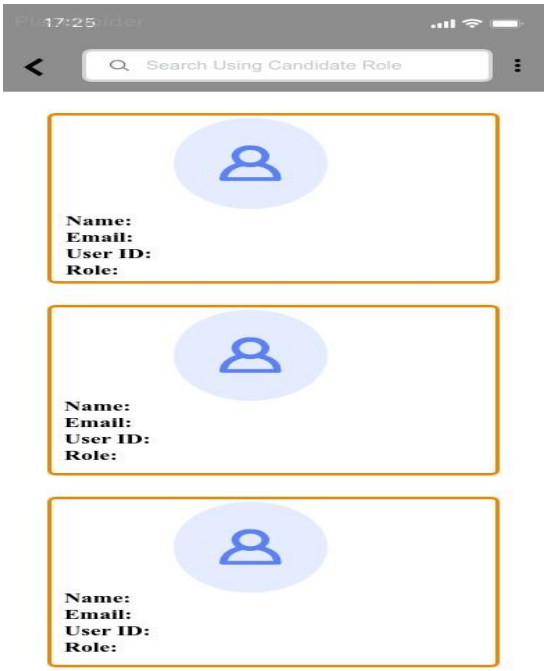

Figure 5.17: View Candidates

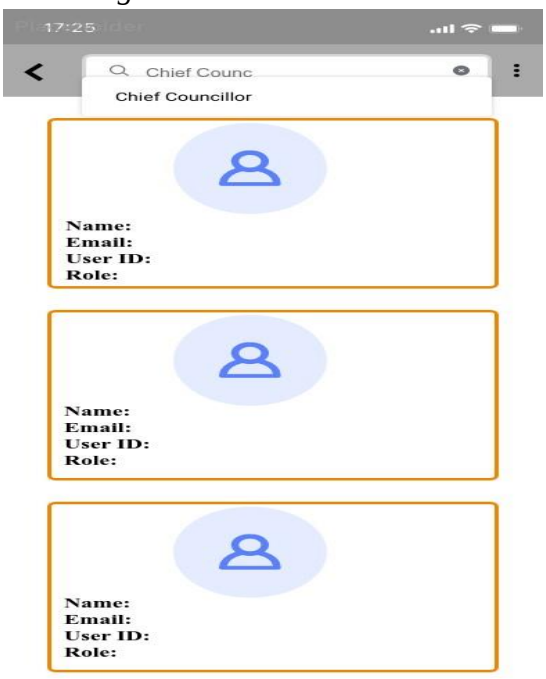

Figure 5.18: Search Candidates

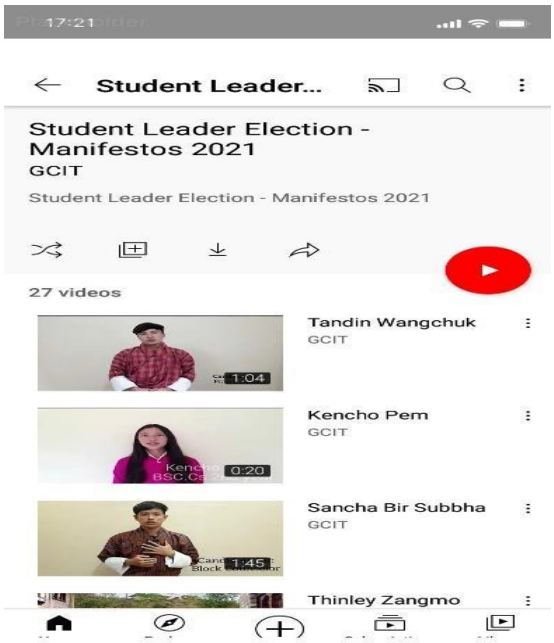

Figure 5.19: View Candidates Manifestos

B. Vote Button

Clicking this vote button will redirect to a page where a page where only the candidates of a specific role will be displayed will a vote button each at the right side. When one of the vote button in this page is clicked then all the other vote buttons will be disabled and the voters will not be able to click the other buttons. There will be a next button at the right bottom corner of the page and clicking this button will redirect to an exact looking page with candidates of a different role/post. The voters is required to vote a single person in a single page and click next until they have finished voting for all the other candidates. After they have finished voting for all the candidates, the vote button in the home page of the user dashboard will be disabled and the voters will not have the privilege to cast vote for the second time.

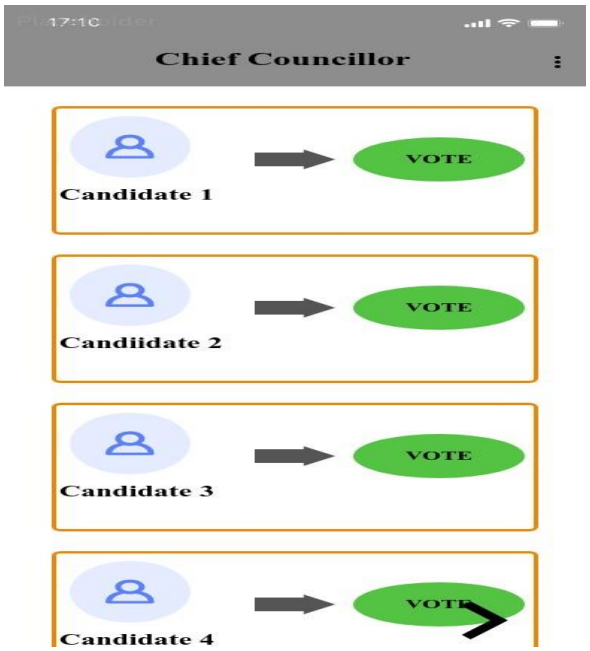

Figure 5.20: Vote Candidate

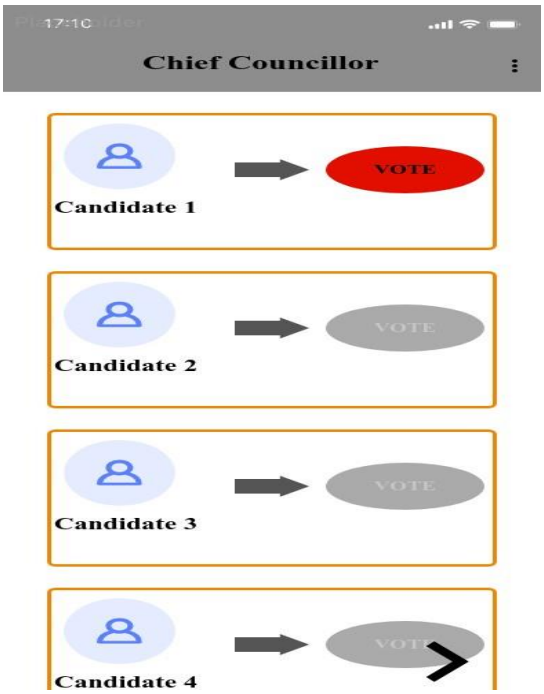

Figure 5.21: Voted Candidate

A. Result Button

Clicking this button will redirect to a page where only the candidates of a particular post/role will be displayed with their personal details and the number of votes they have received from the voters. There will be a next button at the right bottom corner of the page and clicking this button will redirect to an exact looking page with candidates of a different role/post.

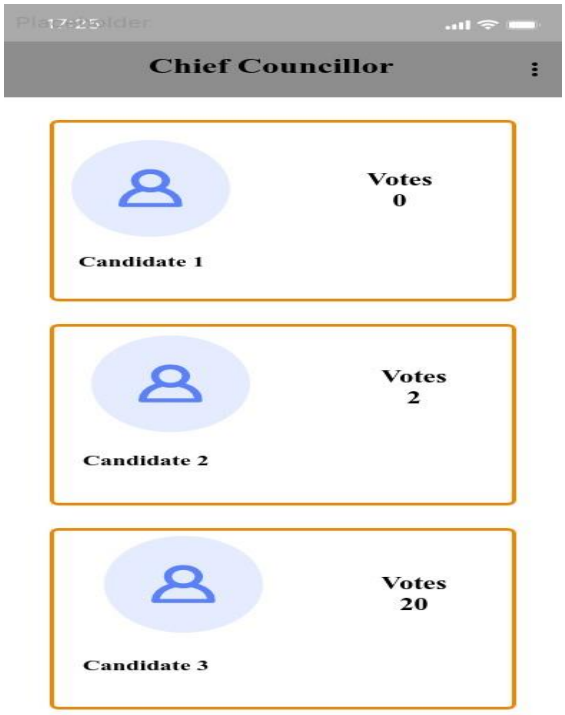

Figure 5.22: Result

iv. Option Menu

Clicking the icon of the option menu placed at the app bar will display the options of this option menu which will contain the following options:

a. User Profile

When clicking on this option will redirect to the voter profile page where the details of a particular voter is displayed. This page also has the option to update/reset the password. Voters can reset their password.

b. About

When clicking on this option will redirected to a new page which will contain a small description of this mobile voting application along with the logo of this application.

c. Logout Voters have the option to logout of the application when not in need or use.

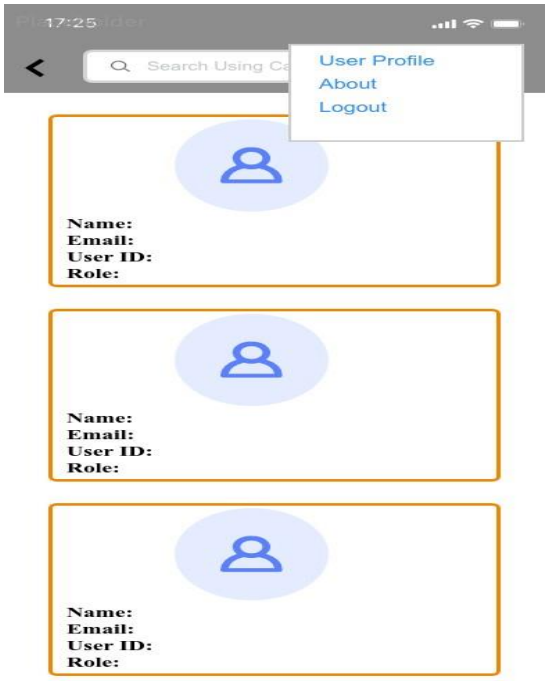

Figure 5.23: User Option Menu

Figure 5.24: User Profile

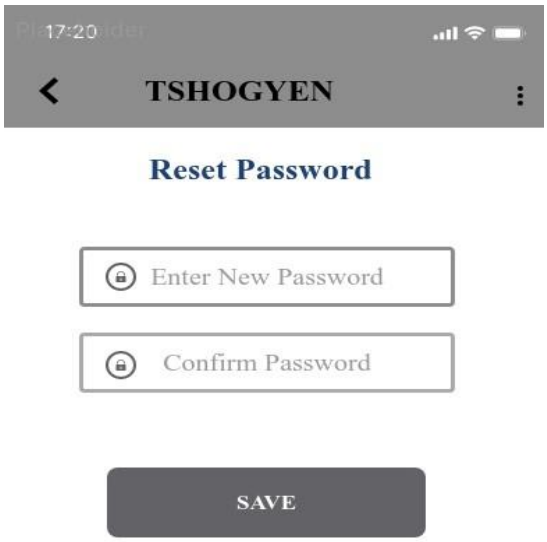

Figure 5.25: User Reset Password

Figure 5.26: About

5.2 USE CASE DIAGRAM

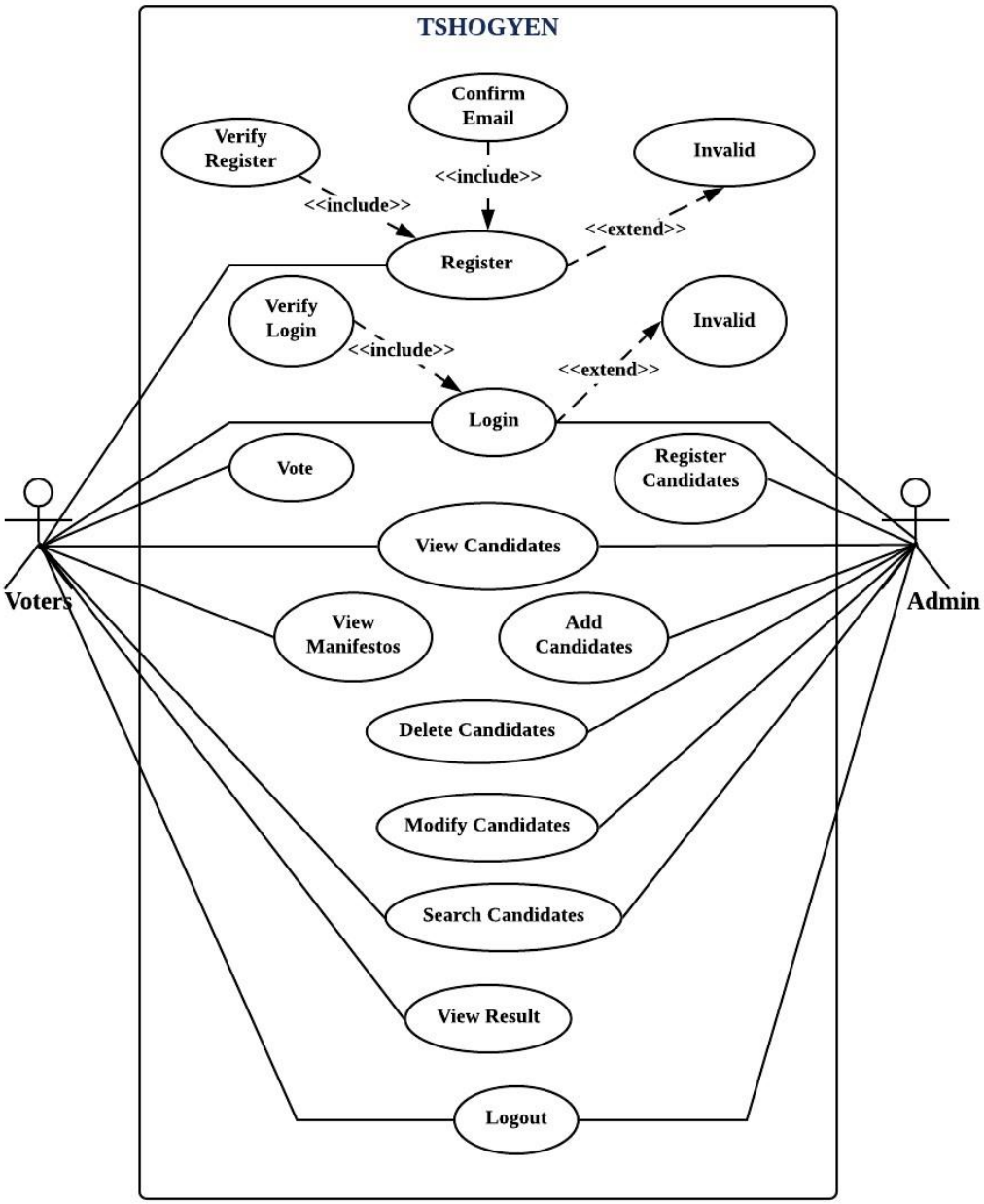

Figure 5.27: Use Case Diagram

5.2.1 USE CASE DESCRIPTION

Use Case	**Register**

Actor	Voters (Primary Actor)
Goal in context	Verify and store the data entered by the voters.
Scenario	i. Voters will enter their personal / required details. ii. System / Application will verify the user entered details. iii. After all the verification, if the voter inputs are invalid then, the details / data will be stored in the database.

Table 5.1: Voter Registration Use Case Description

Use Case	**Login**
Actor	Admin (Secondary Actor) & Voters (Primary Actor)
Goal in context	Verify the login credentials of the pre-registered admin and the registered voters and give access to the system / application.
Scenario	i. Admin and Voters will enter the login details which are email and password. ii. Entered details will be verified / cross-checked with the data stored in the database. iii. If the entered details are valid, then the Admin and Voters will be given access to the system.

Table 5. 2: Login Use Case Description for both Admin & Voters.

Use Case	**Register Candidate**
Actor	Admin (Secondary Actor)
Goal in context	Verify and Store the data entered by the Admin.
Scenario	i. Admin will enter the personal / required details of the candidates. ii. System / Application will verify the entered details. iii. After all the verification, if the candidates' inputs are valid then the details / data will be stored in the database.

Table 5. 3: Candidate Registration Use Case Description.

Use Case	**View Candidates**
Actor	Admin (Secondary Actor) & Voters (Primary Actor)
Goal in context	View t ıe registered candidates' details such as: Photo i. ii. ID iii. Name iv. Email v. Role / post they are competing for.
Scenario	i. ii. Click the View Candidate button Application / System will retrieve the candidates' details from the database and display it in a page.

Table 5.4: Description of the View Candidates Use Case.

Use Case	**Add Candidates**
Actor	Admin (Secondary Actor)
Goal in context	Add new / unregistered candidates. It is basically registering the unregistered candidates with valid data / details.
Scenario	i. Click on the add floating button / icon. ii. Fill out all the empty fields or entering the valid candidates' details. iii. If the entered details are valid then the details are valid then the details are stored in the database.

Table 5.5: Description of the Add Candidates Use Case.

Use Case	**Update Candidates**
Actor	Admin (Secondary Actor)
Goal in context	Update the details of the already registered candidates.
Scenario	i. Hold on a card view of a particular candidate in the view candidate in the view candidate page. ii. Will be prompt with a dialog box with Delete and Update options. iii. Click on the Update option. iv. Modify / Change the details of that particular candidate. v. Modified details will replace the existing details of that particular candidates.

Table 5.6: Description of the Update Candidates Use Case.

Use Case	**Delete Candidates**
Actor	Admin (Secondary Actor)
Goal in context	Delete the details of the registered candidates if required.
Scenario	i. Hold on a card view of a particular candidate in the view candidate page. ii. Will be prompt with a dialog box with Delete and Update options. iii. Click on the Delete option. iv. The particular candidate with its details will be deleted permanently from the database.

Table 5.7: Description of the Delete Candidates Use Case.

Use Case	**Search Candidates**
Actor	Admin (Secondary Actor) & Voters (Primary Actor)
Goal in context	Search registered candidates with respective of their role / post they are competing for.
Scenario	i. Enter a role / post in the search bar. ii. The Application/System will retrieve only the candidates of that particular role and display it in the page.

Table 5. 8: Description of the Search Candidates Use Case.

Use Case	**View Manifestos**
Actor	Voters (Primary Actor)
Goal in context	View the manifestos of all the registered candidates.

Scenario	i. Clicking on a card view of a specific candidate will redirect to the a YouTube page. ii. This YouTube page contains the manifestos of all the registered candidates.

Table 5.9: Description of the View Manifestos Use Case

Use Case	**Vote**
Actor	Voters (Primary Actor)
Goal in context	To vote for the candidates and store this vote count in the database.
Scenario	i. Clicking on a Vote button a particular candidate will increment the vote count of that candidate in the database.

Table 5.10: Description of the Vote Use Case.

Use Case	**View Result**
Actor	Voters (Primary Actor)
Goal in context	To view the vote result of the GCIT Councilors' election.
Scenario	i. Clicking on the View Result button will redirect to a new page. ii. In that page, the details of the candidates along with their total number votes will be displayed.

Table 5.11: Description of the View Result Use Case.

Use Case	**Logout**
Actor	Admin (Secondary Actor) & Voters (Primary Actor)
Goal in context	Disable both Admin and Voters to access the system.

Scenario	**1.** Clicking on the Logout option will automatically disable the Admin and Voters to access the system.

Table 5.12: Description of the Logout Use Case.

5.3 ENTITY RELATIONSHIP DIAGRAM

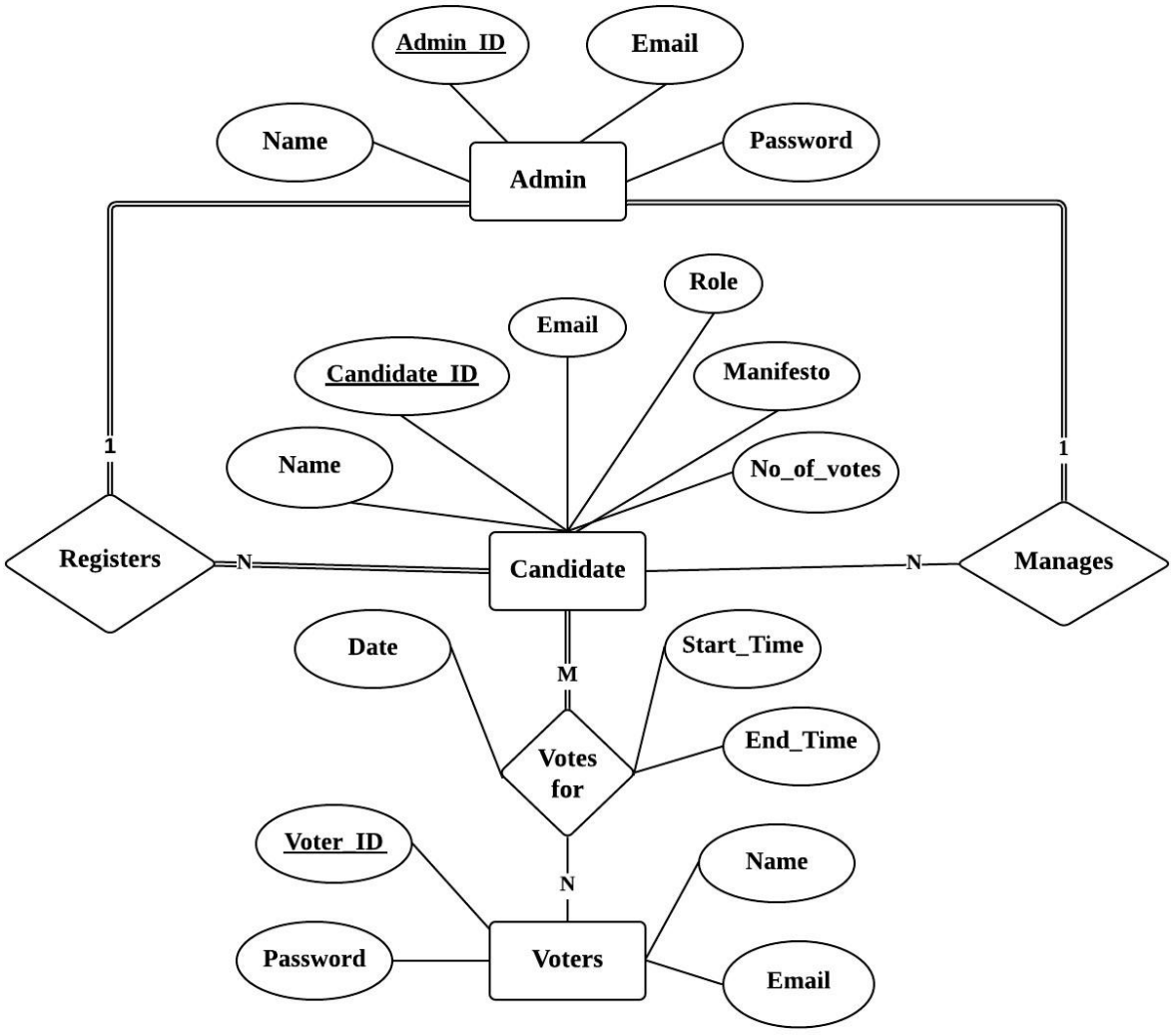

Figure 5.28: entity relationship diagram

5.3.1 ENTITY RELATIONSHIP DIAGRAM DESCRIPTION

This Entity Relationship Diagram (ERD) shows/displays the relationship or how the entities of this application such as voters, candidates and admin relate to each other. This diagram graphically displays the data patterns of this mobile voting application, “Tshogyen”.

There are total of three entities namely:

1. **Admin**

   Entity “Admin” is a strong entity as it has a primary key and does not depend on other entities. Admin will be responsible for registering, updating and deleting the candidates. The Admin entity consists of four attributes which are as follows:

   A. Admin_ID

   Attribue “Admin_ID” has to be unique and therefore is the primary key.

   B. Name

   “Name” here refers to the full name of the admin. Attribute “Name” is a composite attribute as it is composed of many other simple attributes such as Fname (First name), Mname (Middle name) and Sname (Surname).

   C. Email

   Here the attribute “Email” is considered as a single valued attribute because the email field will only accept the GCIT email addresses which has a abc123.gcit@rub.edu.bt format.

D. Password

The attribute “Password” is also a simple attribute. The password field will accept password length of exactly or more than six.

2. Candidates

Entity “Candidates” is a strong entity as it has a primary key and does not depend on other entities. Candidate entity has six attributes as follows:

A. Candidate ID

Attribute “Candidate_ID” has to be unique for every candidate and is a primary key of “Candidate” entity.

B. Name

The attribute “Name” is the full name of candidates. It is also a composite attribute as it is composed of many other simple attributes such as Fname (First name), Mname (Middle name) and Sname (Surname).

C. Email

The attribute “Email” in the candidates entity is also considered as a single valued attribute because the email field will only accept the GCIT email addresses which has a abc123.gcit@rub.edu.bt format.

D. Role

The attribute “Role” is a simple attribute. Role means the post for which the candidates are competing for.

E. Manifestos

The attribute “Manifestos” is also a simple attribute as each candidate will have a single manifesto which is in a video format.

F. Vote count

The attribute “Vote_count” is a simple attribute as voters vote for a candidate, the total number of votes of that candidate will increment from zero (initial value of Vote_count attribute).

3. Voters

The entity “Voters” is also a strong entity as it also consists of a primary key and it does not have to depend on other strong entities. It consists of the following attributes:

A. Voters ID

This attribute “Voters_ID” is a primary key of the entity “Voters” and it uniquely identifies this entity.

B. Name

The attribute “Name” in this Voters entity refers to the full name of the voters. It is a composite attribute as it is composed of other three attributes which are Fname (First name), Name (Middle name) and Sname (Sur name).

C. Email

The attribute “Email” is considered as a single valued attribute because the email field will only accept the GCIT email addresses which has a abc123.gcit@rub.edu.bt format.

D. Password

The attribute “Password” is also a simple attribute. The password field will accept password length of exactly or more than six.

There are three relationships in this ER diagram of the mobile application “Tshogyen” and they are as follows:

1. Registers

This relationship exists between the admin entity and candidate entity. It indicates that the admin will register the candidates or candidates will be registered by the admin.

2. Manages

This relationship exists between the admin entity and candidate entity. This relationship conveys the message that the admin will manage (add, update, & delete) the candidates or the candidates will be managed by the admin.

3. Votes for

This relationship exists between the voters and the candidates. This relationship means that the voters will vote for the candidates. This relation has three attributes which are Date (election date), Start_Time (Start time of the election) and End_Time (end time of the election).

5.4 ADMIN SEQUENCE DIAGRAM

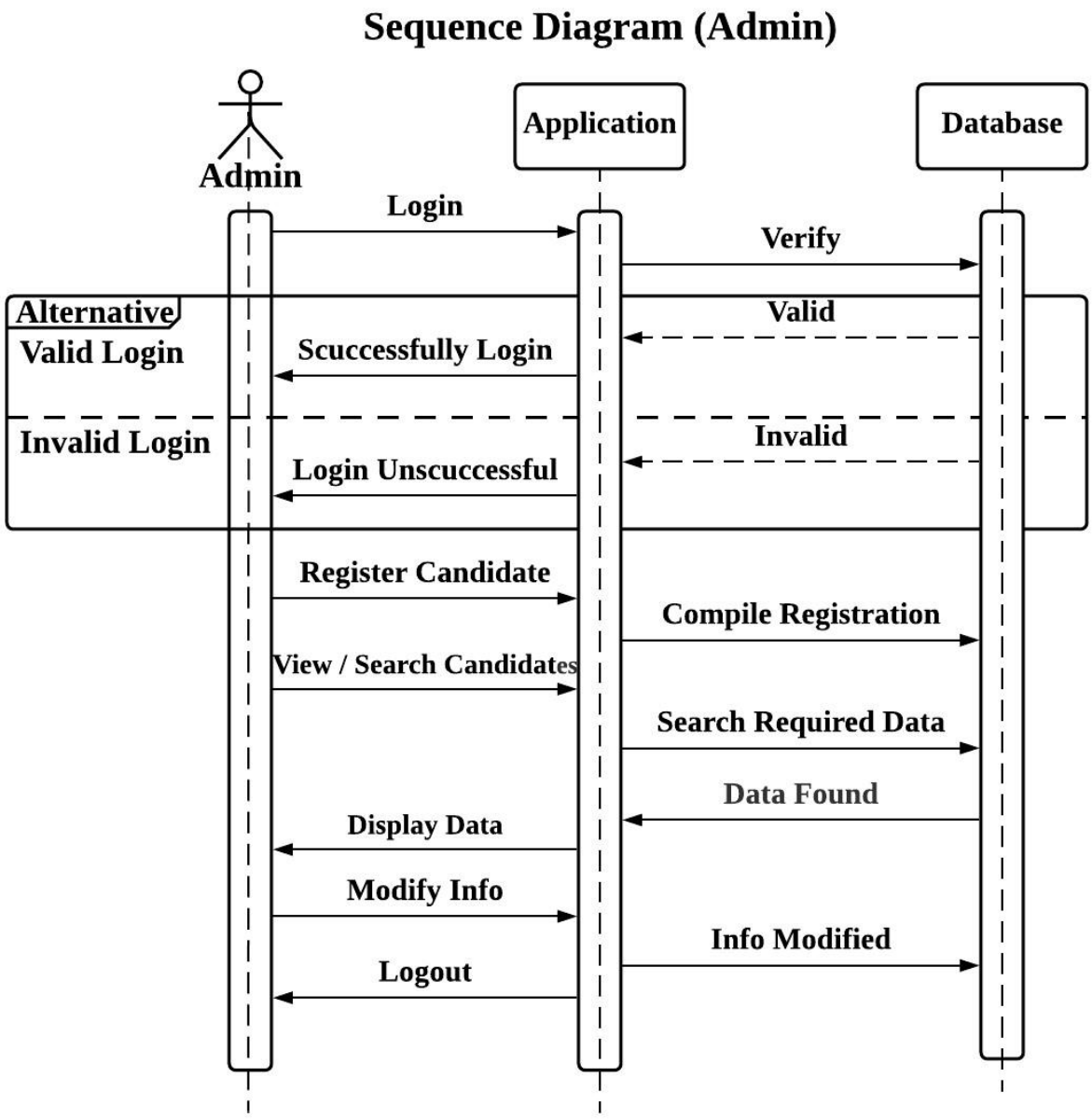

Figure 5.29: Admin Sequence Diagram

5.4.1 ADMIN SEQUENCE DIAGRAM DESCRIPTION

In this Admin Sequence Diagram of the mobile voting application “Tshogyen”, there are three actors which are the Admin, Application and Database. The admin is pre-registered

and therefore the admin can directly access the system by logging in with the right credentials. If login credentials are valid then the admin will be able to successfully login but if the credentials are invalid then an error message will pop up. After successfully login, the admin can perform tasks such as register, view, update, search and delete candidates. The admin registers the candidates with valid data / details and these data are compiled/stored in the database. When viewing or searching in data, the system / application requests the data search in the database and if the search/required data matches the data stored in the database then this data is retrieved and displayed to view. When candidates are deleted, it is permanently deleted/erased from the database. Then the final function / operation a admin can perform is to logout or exit from the database.

5.5 VOTERS SEQUENCE DIAGRAM

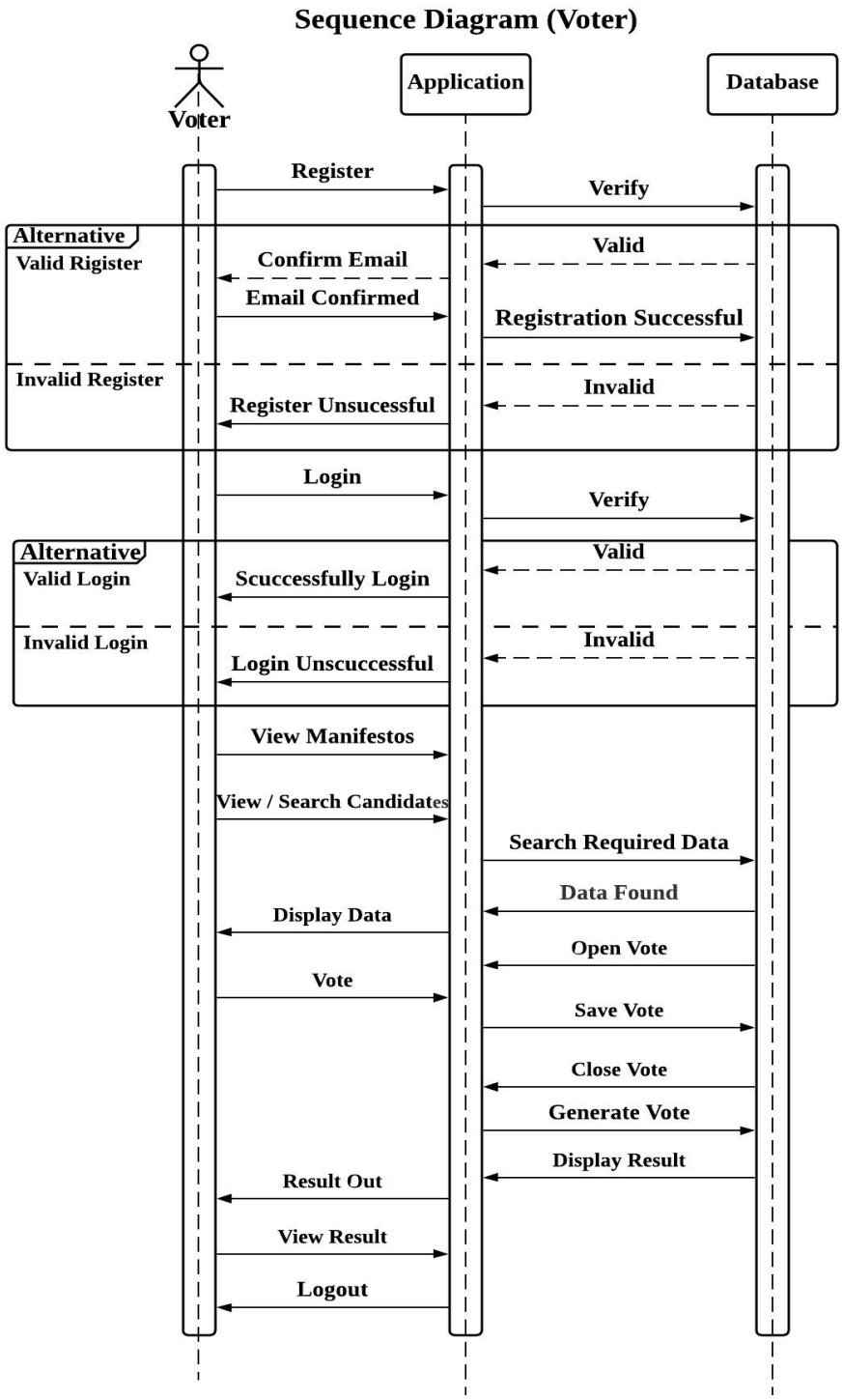

Figure 5.30: Voters Sequence Diagram

5.5.1 VOTERS SEQUENCE DIAGRAM DESCRIPTION

In this Voters' Sequence Diagram of the mobile voting application "Tshogyen", there are three actors namely Users/Voters, Application and Database. Voters (staff and students of Gyalpozhing College of Information Technology) have to register first in order to access this application. The voters register by entering the valid credentials in the application and the application verifies if the entered data is valid or not and if it is valid then, the voters are successfully registered into the system. But if the entered data are not valid then the voters are not registered. After the successful registration, the voters can access the system by logging in with the right credentials which is email and password. When the email and password are entered in the application, the system checks if any of the stored data in the database matches with the entered data. If there is a match then the voter is successfully logged in but if not, the voter will be required to login again. If the login is successful then the voters will be able to view and search candidates and also view the manifestos. When viewing or searching for data, the application looks for any match in the database and if there is a match then this data is retrieved and displayed. After the vote feature is enabled, the voters will be able to vote for their selected candidates and after the voting process is finished, the vote feature closes. When viewing the result, the candidate details and the votes are generated / retrieved from the database and displayed for viewing. Then the final function / operation the admin can perform is to logout or exit from the database.

5.6 RELATION SECHEMA DIAGRAM

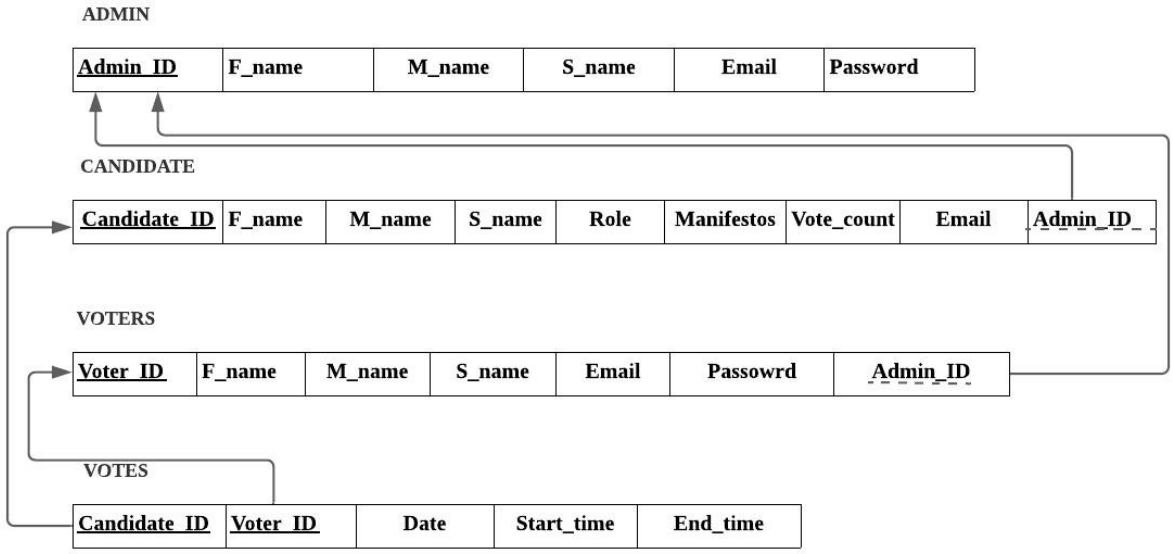

Figure 5.31: Relation Schema Diagram

5.6.1 RELATION SECHEMA DIAGRAM DESCRIPTION

This mobile voting application consists of four tables namely; Admin, Candidate, Voters and Votes_for.

Table Admin includes six columns; Admin_ID (primary key), F_name, M_name, S_name, Email and Password.

Table Candidates includes nine columns; Candidate_ID (primary key), F_name, M_name, S_name, Email, Role, Vote_count, Manifesto, Admin_ID (Foregin key).

Table Voters includes six columns; Voter_ID (primary key), F_name, M_name, S_name, Email and Password.

Table Votes_for includes five columns; Voter_ID (Foregin key), Candidate_ID (Foregin key), Date, Start_time and End_time. The combination of two foregin keys (Voter_ID and Candidate_ID) makes up the primary key.

CHAPTER 6: RESULTS

This chapter contains the screenshots and the explanation of the final working application. It contains a brief introduction of this mobile voting application "Tshogyen" and the features provided by this application with the corresponding screenshots respectively.

6.1 INTRODUCTION TO THE SYSTEM

"Tshogyen" is a mobile application developed for the purpose of conducting election in GCIT for the selection of councillors. This application makes the voting process much more for both the user; admin (to conduct the election) and the voters (cast vote). It focuses on making the selection of GCIT student bodies an effective, efficient and error free process.

6.2 TSHOGYEN

This mobile voting application was developed using the prototype that was predesigned. We have developed the application using Android Studio for the user interface design and fireStore database for storing the data. The following screenshots are the real-time interface of this application.

App Icon: The icon of our mobile application is a picture of a hand casting a vote which indicates the purpose of our application which is voting. The color for the logo was kept as color blue because blue signifies fair, justice and freedom which perfectly suits the motto of our application which is to conduct GCIT election in a justice and fair manner. The wordings around the logo are "Tshogyen" which means voting and "Gyelposhing College of Information Technology" which indicates that this mobile voting application is for GCIT.

Figure 6.1: Logo

Splash screen: The figure is the splash screen of this application. The splash screen contains the Tshogyen's logo and the wording "TSHOGYEN" with a little animation effect. The splash screen entirely covers the page of the application and it is the launcher page of this application.

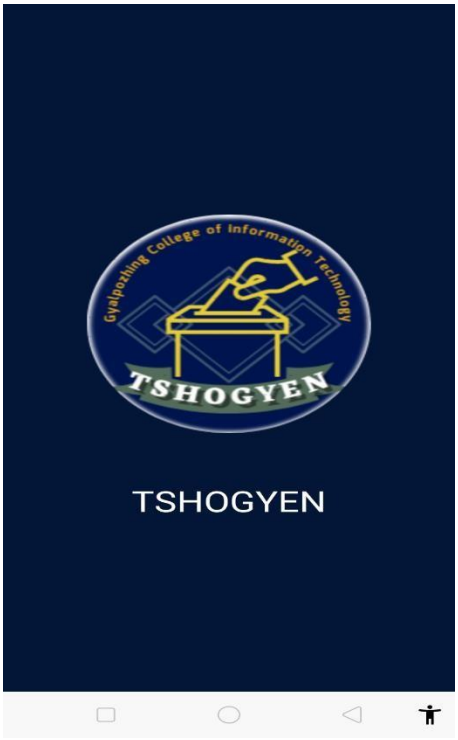

Figure 6.2: Splash Screen

ADMIN

i. Admin Login

After the splash scrren the page to be displyed for this mobile voting application is the login page. Both the admin and the voters have the same login page. Admin is

not be required to register as he/she is already pre-registered. Admin login page consists the followings:

1. **Image View:** This image consist the logo of this application.
2. **Email field**: This is a text view which requires email. This field cannot be empty and the entered email should be the GCIT email with the correct format.
3. **Password field:** This is also a text view with the input type password. This field cannot be empty and the password length entered should be exactly or more than six.
4. **Show Password** : It is a check box which when checked, displays the password and helps in knowing if the correct password is entered or not.
5. **Forgot Password:** It is a text view and when clicked, a dialog box pops up for entering the email address so that the system can send a password reset link to this email. This link helps the system to confirm that the right person trying to access the application.

Email address and the password are required in order to login to the application. All the validation for the login page such as the right email address validation and the correct password validation will be taken into consideration seriously. The admin has to enter the right login inputs to log into the app but if the entered inputs does not match with the pre-registered data then the admin will not be able to log into the application. Clicking the '**Login**' button after entering the valid credentials will redirect the admin to home page of the admin dashboard.

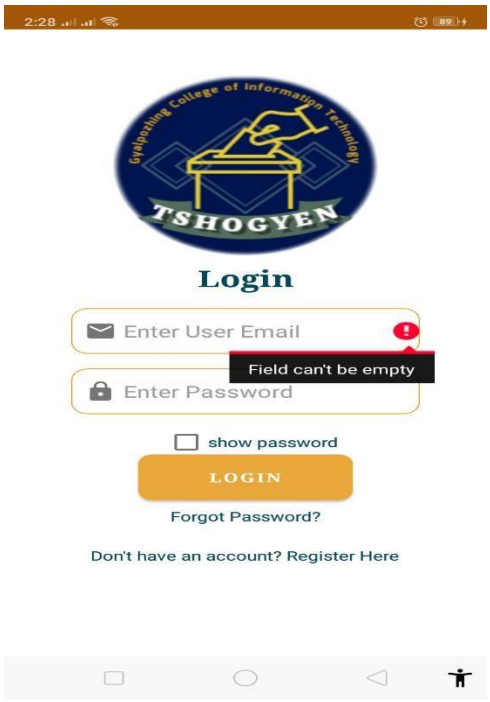

Figure 6.3: Admin Login-Empty Field

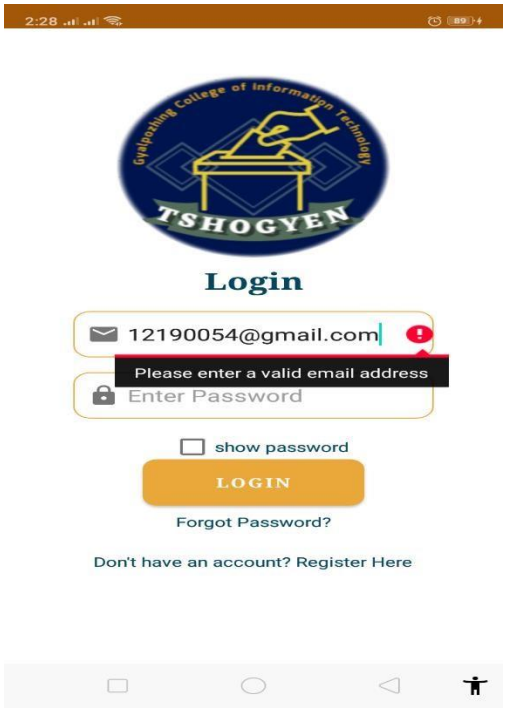

Figure 6.4: Admin Login-Invalid Email

Figure 6.5: Admin Login-Show Password

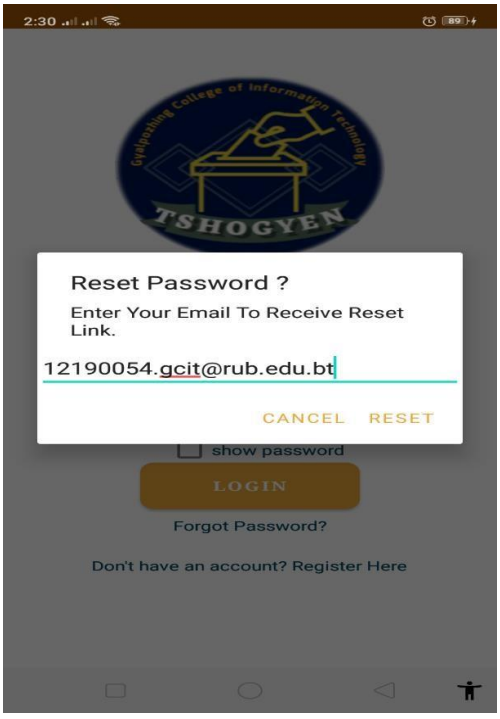

Figure 6.6: Admin Login-Forgot Password

Figure 6.7: Admin Login-Reset Link Sent

ii. Home Page of Admin Dashboard

After the successful login, the admin is redirected to the home page of the admin dashboard which contains an image slider and two buttons; candidate registration button and view candidate button. Image slider consists the application's logo and two other images which indicates mobile voting.

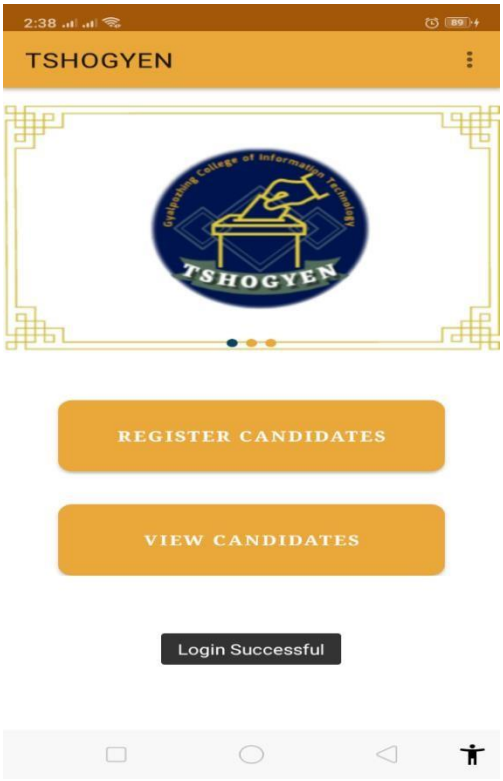

Figure 6.8: Admin Home page

A. Candidate registration button

Clicking this button redirects to the candidate registration page. The candidates are registered by the admin with the required credentials such as profile photo, name, email, student id and the role/post they are competing for. In order to successfully register the candidates, the admin has to fill all the text fields with the correct data. After entering all the right credentials and clicking/tabbing on the 'Register' button, the candidates will be registered in the database (Fire Store).

The validation done for the candidate registration are as follows:
Profile photo: A picture has to be selected from the gallery.
Name: The name field can only accept the text input.
Candidate ID: This field can accept only the numbers/digits as an input. The id has to be the length of exactly or more than six.
Email: The email field only accepts the GCIT emails and no other email. This ensures that the candidates participating are only the students of GCIT. **Role:** This role field has to be entered with correct spelling. The automatic related text are generated when entering a few letters in this field which helps a lot.

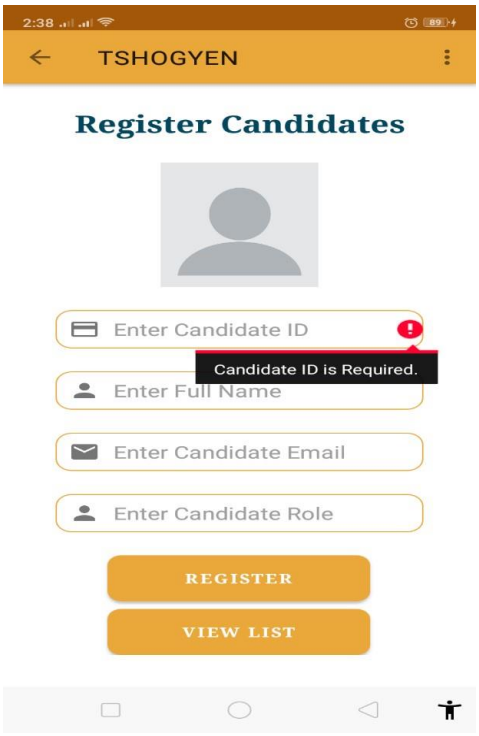

Figure 6.9: Candidate Registration-Empty Field

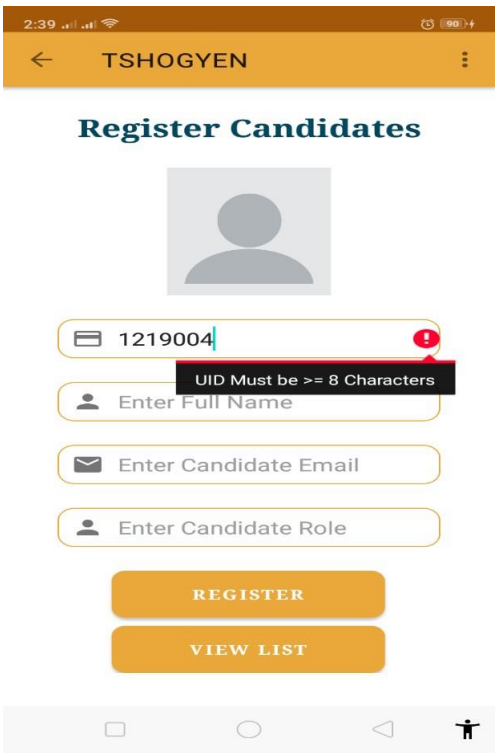

Figure 6.10: Candidate Registration-Invalid ID

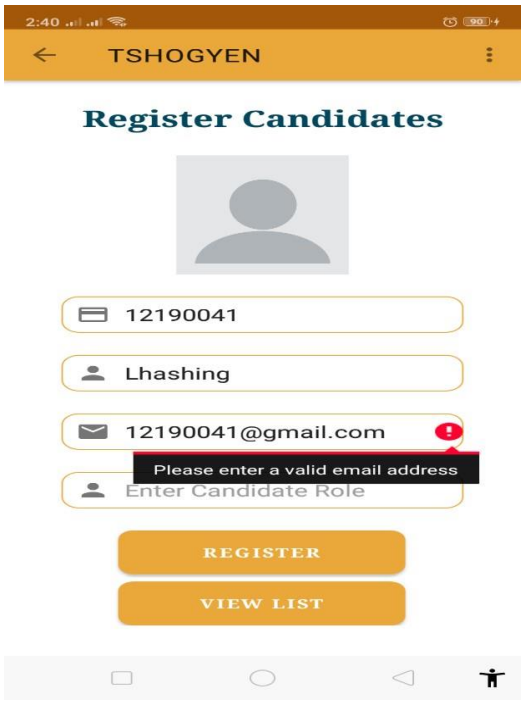

Figure 6.11: Candidate Registration-Invalid Email

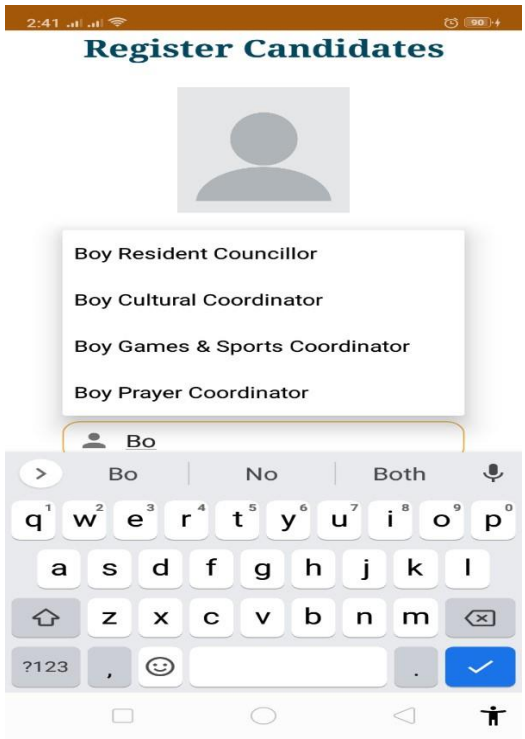

Figure 6.12: Candidate Registration-Correct Role

Figure 6.13: candidates Successfully Registered

B. View Candidates button

Clicking this button redirects to another page where the admin will be able to perform the following five functions: **a. View (figure 6.14)**

Clicking the view candidate's button redirects to a page where all the registered candidates will be listed/displayed with all the registered information such as the candidate image, name, user id and the role.

b. Add (figure 6.14)

Clicking the plus sign placed at the right below corner of the page redirects to the candidate registration page where the admin can register the unregistered candidates.

c. Update (figure 6.16)

Holding a card view of a specific candidate for 2 seconds will pop up a dialog box which contains the update and the delete options. When clicking the update button will redirect to the update page. Then the admin can update the information of the candidates.

d. Delete (figure 6.18)

Holding a card view of a specific candidate for 2 seconds will pop up a dialog box which contains the update and the delete options. When clicking the delete button will again pop up a dialog box stating the delete and cancel option. Clicking on the cancel button will not delete the candidate but the if the delete option is clicked then the specific candidate will be deleted from the database permanently.

e. Search (figure 6.15)

At the top of the view candidate page contains the search bar. The admin can search for the registered candidates respective of their role/post. Entering a particular role/post in this search bar will list/ display only the candidates of this role/post.

Figure 6.14: Admin-View Candidates

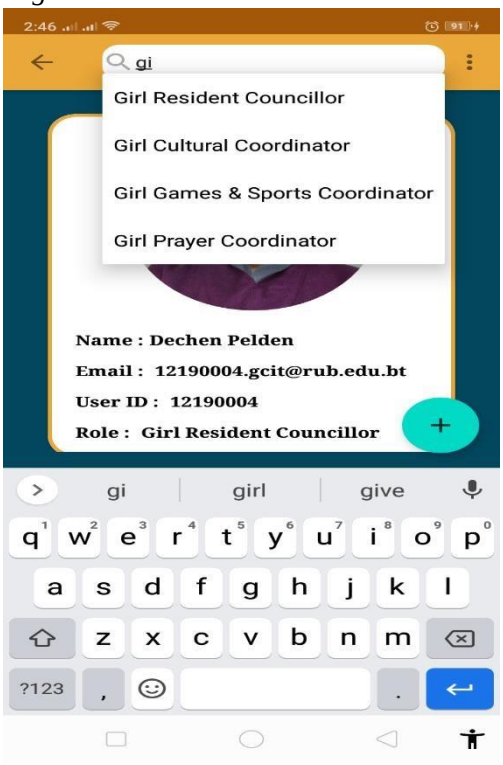

Figure 6.15: Admin-Search Candidates by Role

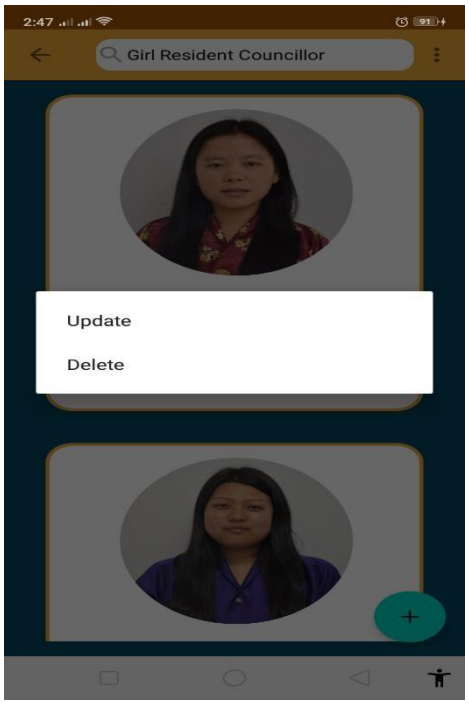

Figure 6.16: Admin-Update Candidate

Figure 6.17: Admin-Candidate Successfully Updated

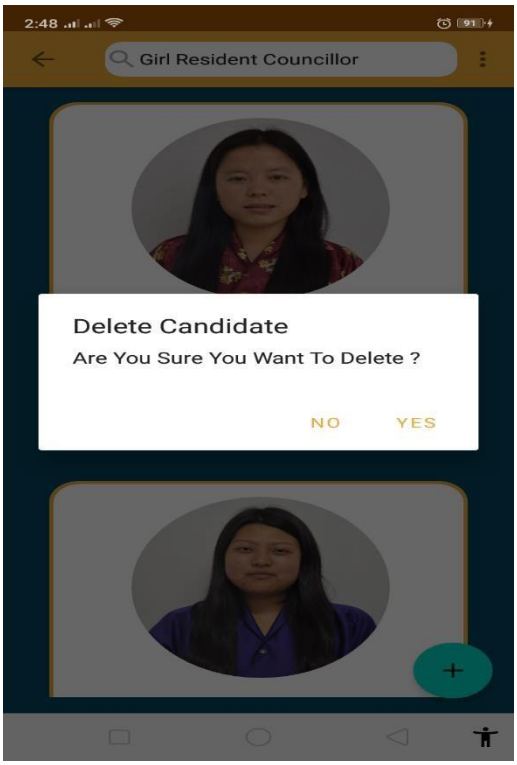

Figure 6.18: Admin-Delete Dialog Box

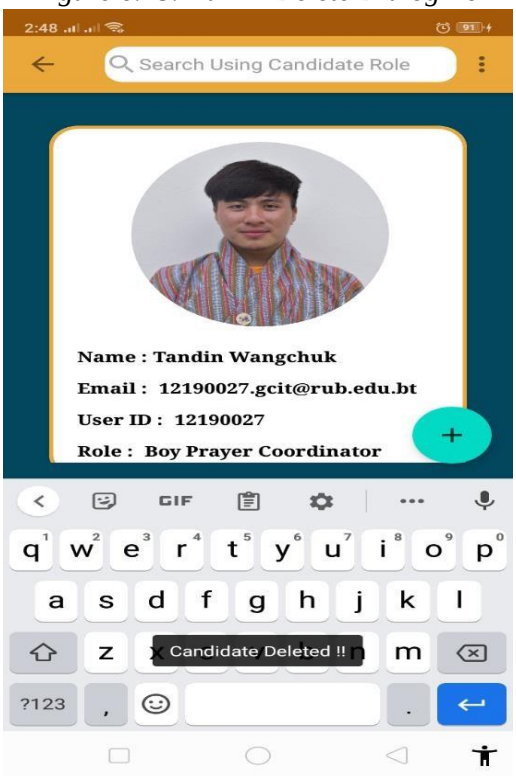

Figure 6.19: Admin-Candidate Successfully Deleted

iii. Option Menu

Clicking the icon of the option menu placed at the app bar will display the options of this option menu which will contain the following options:

a. Admin Profile

When clicking on this option redirects to the admin profile page where the details of the admin is displayed. This page also has the option to update/reset the password. Admin can reset his/her password.

b. About

When clicking on this option will redirected to a new page which will contain a small description of this mobile voting application along with the logo of this application.

c. Logout

Admin has the option to logout of the application when not in need or use.

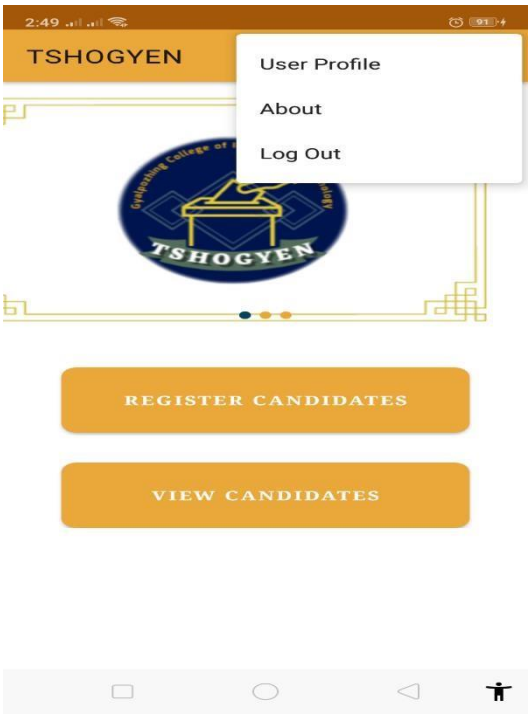

Figure 6.20: Admin-Option Menu

Figure 6.21: Admin-Profile

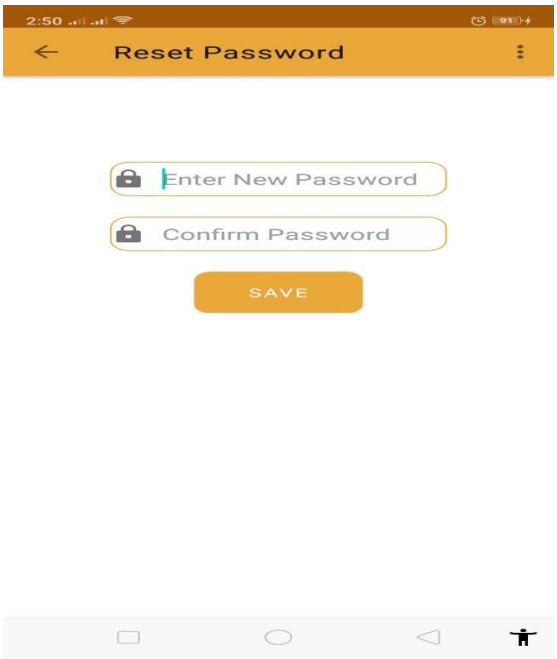

Figure 6.22: Admin-Reset Password

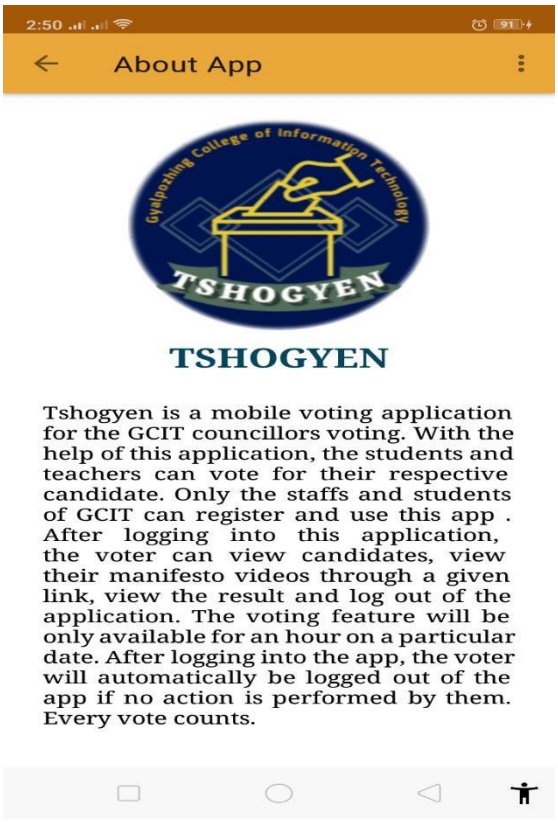

Figure 6.23: About

VOTERS

In the voter/user dashboard, it contains the following functionalities as follows:

i. Voter Registration

Unlike admin, the voters are not pre-registered and therefore they have to register first in order to log into the system. The launcher page of the voter dashboard is also the login page and therefore the voter will be redirected to the login page when opening this application. If the voter has not registered then they can click on the option 'Register' and they will be redirected to the voter registration page. The voters will be required to register with some specific data such as name, id (student/ employee id), email, password and a confirm password. And clicking the 'Register' button, the voters will be sent an email

confirmation link and only after confirming this link, the voters gets registered successfully.

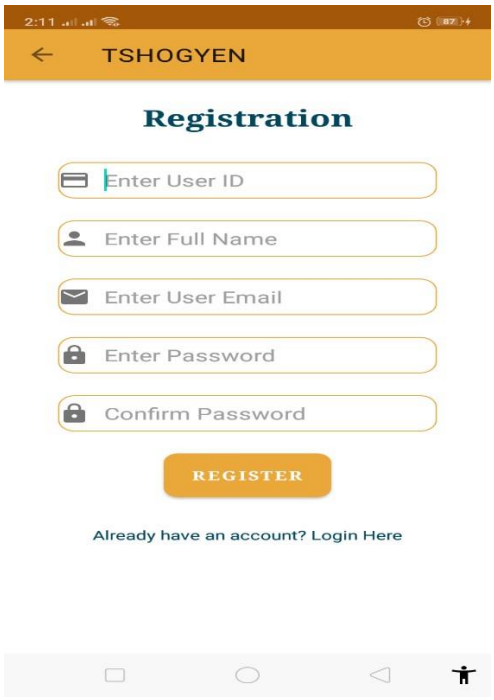

Figure 6.24: Voters Registration

The validation done for the candidate registration are as follows:

1. **Name:** The name field can only accept the text input.**Voter ID:** This field can accept only the numbers/digits as an input. The id has to be the length of exactly or more than six.
2. **Email:** The email field only accepts the GCIT emails and no other email. This ensures that the candidates participating are only the students of GCIT.
3. **Password:** This field accepts the password length of exactly or more than six.
4. **Confirm Password:** The content of this field should be exact of the password field. This field ensures that the right password id is registered.

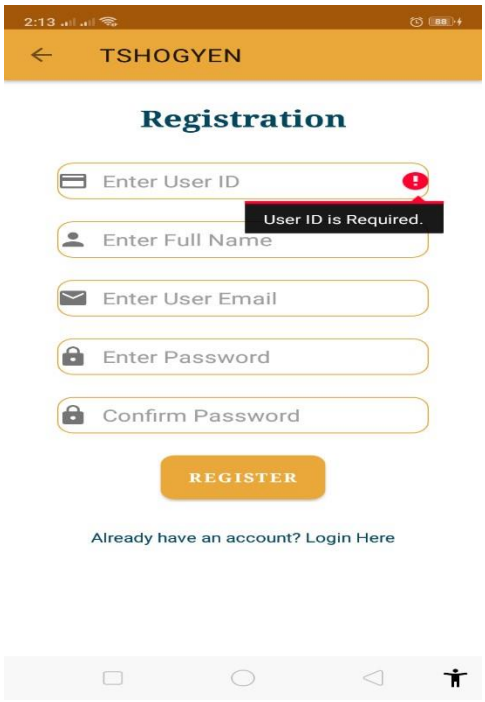

Figure 6.25: Voters Registration-Empty Fields

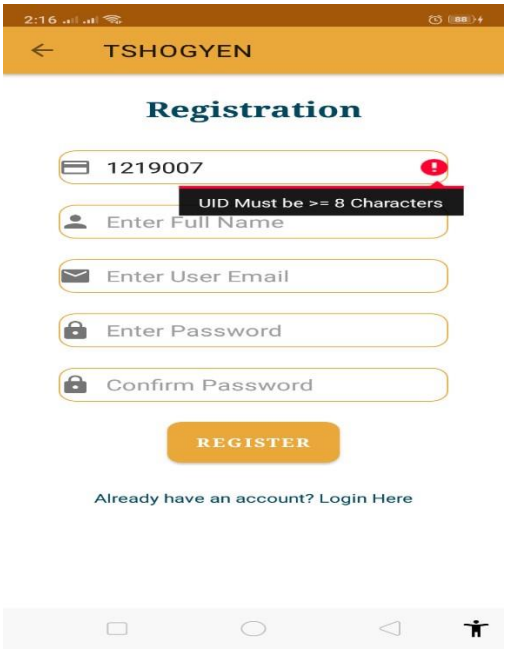

Figure 6.26: Voters Registration-Invalid id

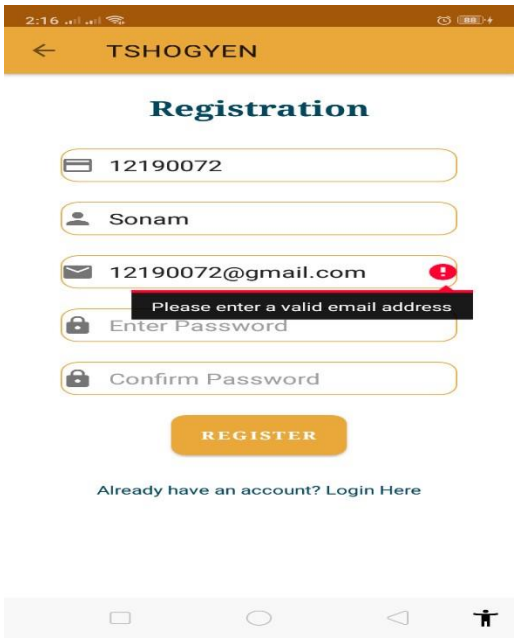

Figure 6.27: Voters Registration-Invalid email

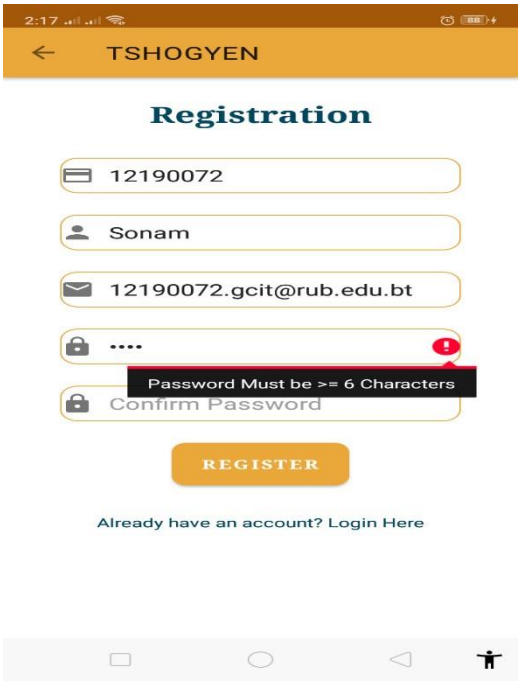

Figure 6.28: Voters Registration-Invalid password

Figure 6.29: Voters Registration-Invalid confirm password

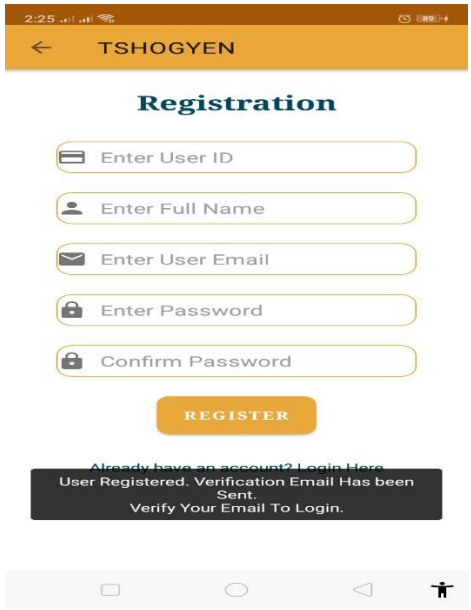

Figure 6.30: Voters Registration-Email verification link sent

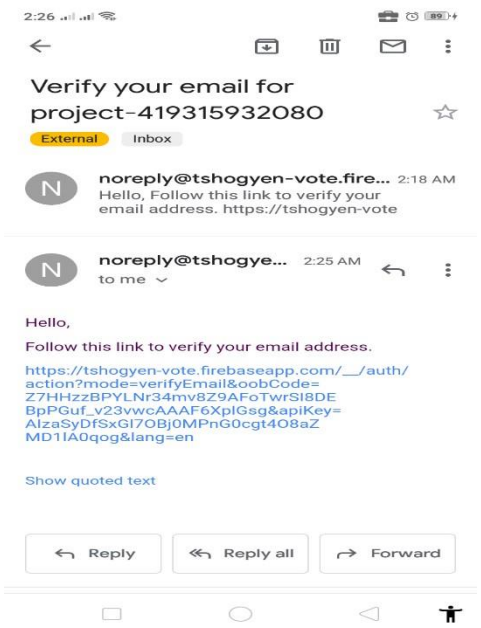

Figure 6.31: Voters Registration-Email verification link received

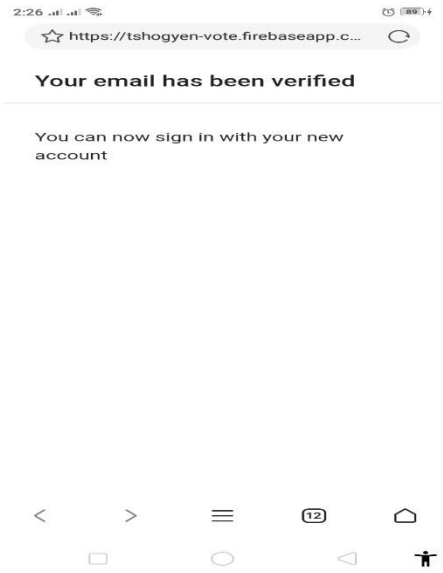

Figure 6.32: Voters Registration-Email confirmed

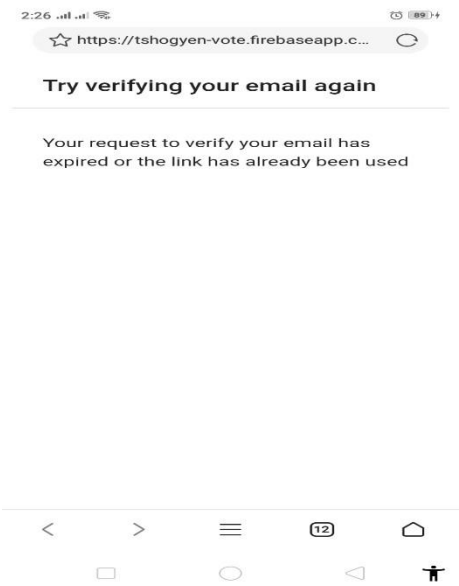

Figure 6.33: Voters Registration-Same email cannot be confirmed **ii. Voter Login**

The login page of both admin and voters is same and therefore has the same layout with the exact fields.

After the successful registration of the voters, the voters will be able to log into the application with the required details such as name and email. The details entered in the login page has to match one of the data stored in the database and then only will the voters be able to log into the application successfully. All the validation for the login page such as the right email address validation and the correct password validation will be taken into consideration seriously. Clicking the 'Login' button after entering the valid credentials will redirect the voters to the home page of the user dashboard.

Figure 6.34: Voters login

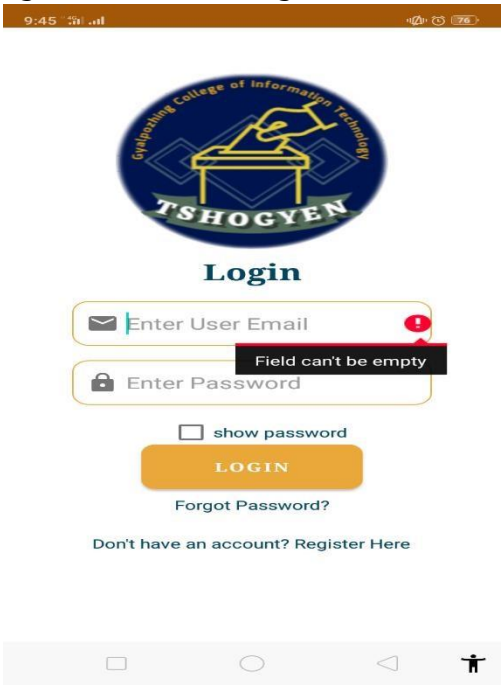

Figure 6.35: Voters login-Empty fields

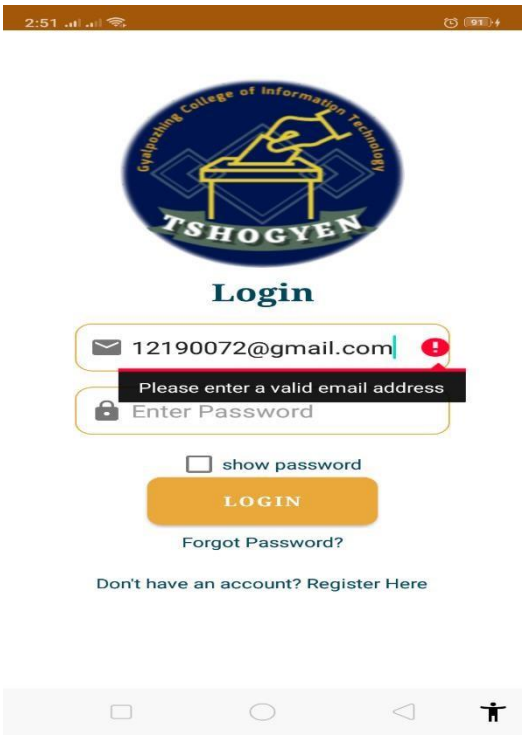

Figure 6.36: Voters login-Invalid Email

Figure 6.37: Voters login-Invalid password

Figure 6.38: Voters login-Show password

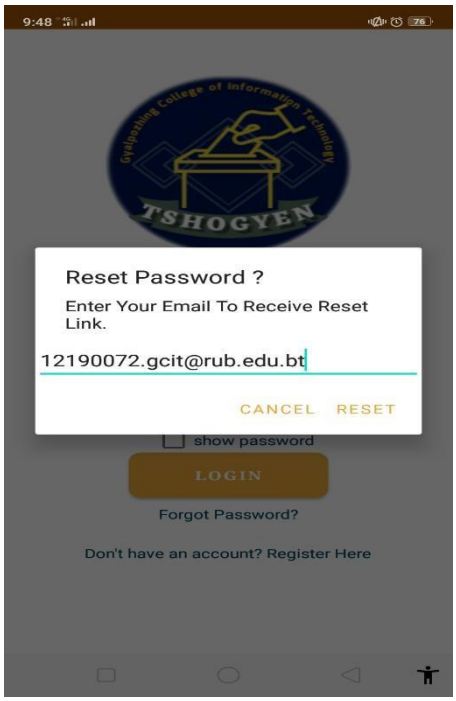

Figure 6.39: Voters login-Reset password link sent

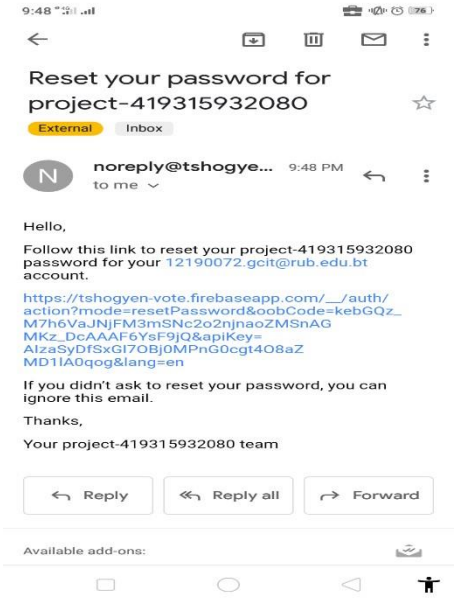

Figure 6.40: Voters login-Reset password link received

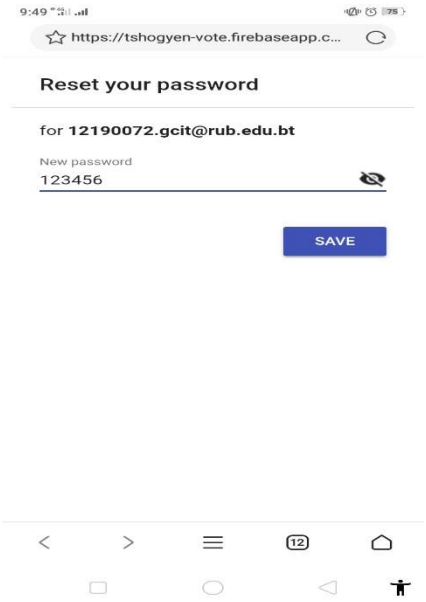

Figure 6.41: Voters login-Entering new password

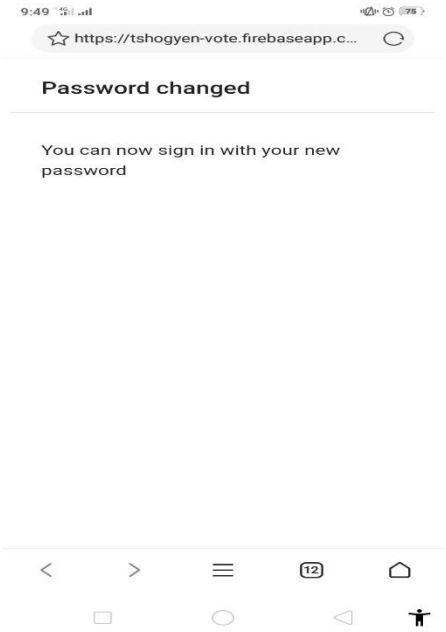

Figure 6.42: Voters login-new password successfully reset

iii. Home page of User Dashboard

After the successful login, the voters are redirected to the home page of the user dashboard which contains an image slider and three buttons; candidate button, vote button and the result button. . Image slider consists the application's logo and two other images which indicates mobile voting.

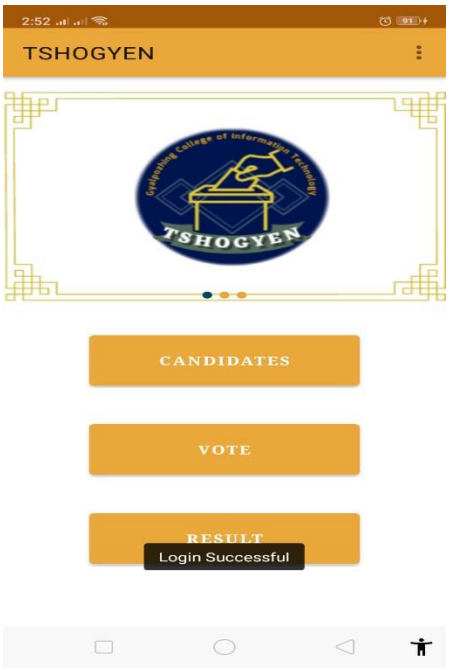

Figure 6.43: User Homepage (successful login)

A. Candidate Button

Clicking this candidate button in the user dashboard will redirect the voters to another page where the voters will be able to perform the following three functionalities: a. View

Right after clicking the candidate button the voters will be redirected to a page where all the registered candidates will be displayed. The candidate details such as their name, student id and role/post along with their photo will be displayed. b. Search

The search bar located at the top of the page will help make the viewing of the candidates' process an easy task as the voters will be required to just enter a role/post and all the candidates for that role will be displayed.

c. Manifesto

When clicking one of the card view of a specific candidate will redirect the voters to a YouTube page where the manifestos of all the registered candidates

which are in the video format are uploaded. This enables the voter to view the manifestos in a convenient way.

Figure 6.44: Voters-view candidates

Figure 6.45: Voters-Search candidates

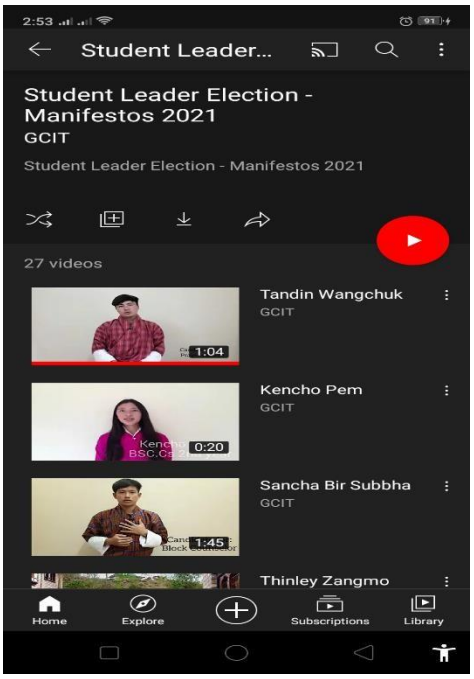

Figure 6.46: Voters-View manifestos

B. Vote Button

Clicking this vote button will redirect to a page where a page where only the candidates of a specific role will be displayed will a vote button each at the right side. When one of the vote button in this page is clicked then all the other vote buttons will be disabled and the voters will not be able to click the other buttons. There will be a next button at the right bottom corner of the page and clicking this button will redirect to an exact looking page with candidates of a different role/post. The voters is required to vote a single person in a single page and click next until they have finished voting for all the other candidates. After they have finished voting for all the candidates, the vote button in the home page of the user dashboard will be disabled and the voters will not have the privilege to cast vote for the second time.

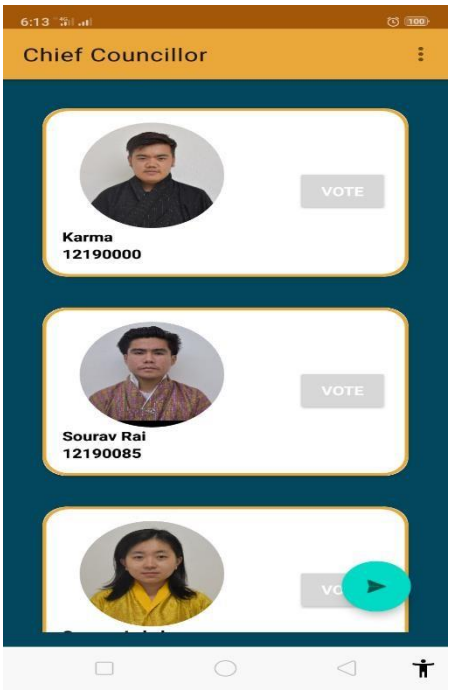

Figure 47: Vote Candidates

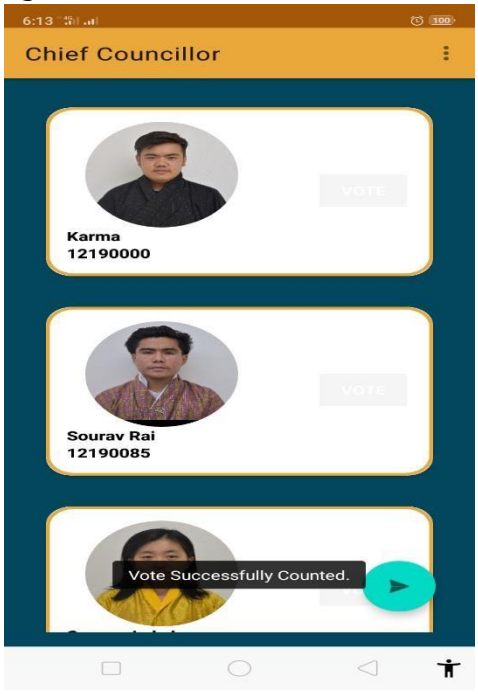

Figure 6.48: Vote successfully counted)

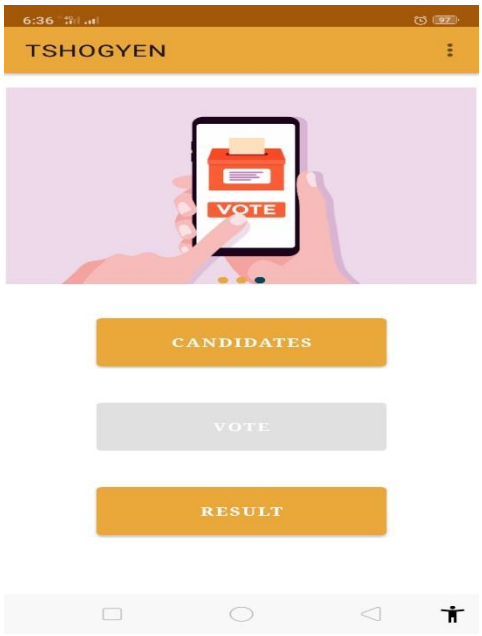

Figure 6.49: Vote button disabled

C. Result Button

Clicking this button will redirect to a page where only the candidates of a particular post/role will be displayed with their personal details and the number of votes they have received from the voters. There will be a next button at the right bottom corner of the page and clicking this button will redirect to an exact looking page with candidates of a different role/post.

Figure 6.50: View result

iv. Option Menu

Clicking the icon of the option menu placed at the app bar will display the options of this option menu which will contain the following options:

A. User Profile

When clicking on this option will redirect to the voter profile page where the details of a particular voter is displayed. This page also has the option to update/reset the password. Voters can reset their password.

B. About

When clicking on this option will redirected to a new page which will contain a small description of this mobile voting application along with the logo of this application.

C. Logout

Voters have the option to logout of the application when not in need or use.

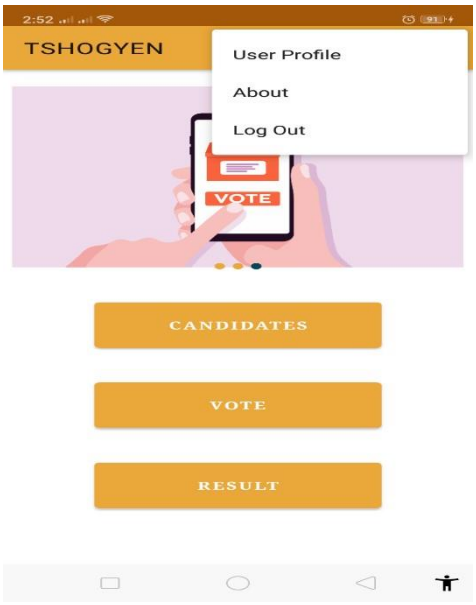

Figure 6.51: Voters-Options Menu

Figure 6.52: Voters-User/voter profile

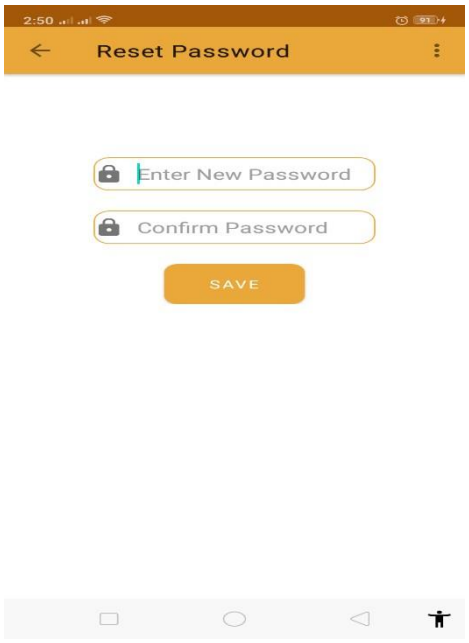

Figure 6.53: Voters-Reset password

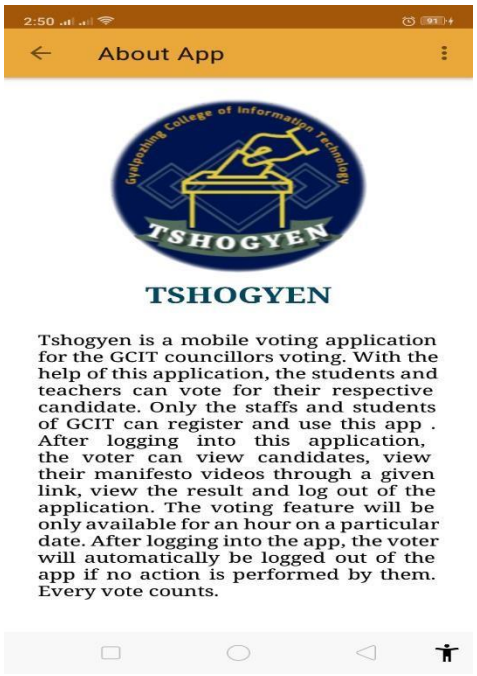

Figure 6.54: Voters-About

6.3 TESTING

Testing case: 1 **Project name:** Tshogyen

Module: Functional Testing

Function specification: Admin Login

Test objective: Admin login successfully

Test Case Title	Description	Steps	Expected	Actual	Status
Admin login. Authenticate Successful login.	A pre-registered admin should be able to successfully login.	Enter the valid credentials; email and password of the pre-registered admin and click login.	Admin Dashboard should be displayed.	Home screen of admin dashboard is displayed.	Pass

Table 6.1: Test case 1

Testing case: 2 **Project name:** Tshogyen

Module: Functional Testing

Function specification: Candidates registration

Test objective: Successful Candidates registration

Test Case Title	Description	Steps	Expected	Actual	Status
Candidates Registration.	Admin registers the candidates.	Admin needs to provide candidates' profile photo, email id, name, Candidate id and role.	No error message is displayed.	Candidates are successfully registered. Message: Registered successfully.	Pass
	Check candidate's email Id.	If the candidate has provided a GCIT email with	No error message.	Email Id accepted.	Pass
		abc123.gcit@rub.edu.bt format.			

	Check candidate's name / username.	If the candidate's name is a text input.	No error message.	Name/Username Accepted.	Pass
	Check candidate's id.	If the given candidate's id is of length exactly eight and above.	No error message.	Candidate's id accepted.	Pass
	Check candidate's profile photo	If an image is uploaded	No error message.	Profile photo accepted	Pass
	Check candidates role	If the candidate role field is not empty.	No error massage.	Candidate's role is accepted	Pass

Table 6.2: Test case 2

Testing case: 3 **Project name:** Tshogyen

Module: Functional Testing

Function specification: Voters registration

Test objective: Successful Voters registration

Test Case Title	**Description**	**Steps**	**Expected**	**Actual**	**Status**
Voter Registration.	Voter has to register in order to access this application.	Voters need to provide email's id, name, voter's id, and password and confirm password.	No error message is displayed.	Voters are successfully registered. Message: Successfully registered.	Pass
	Checks voters email Id.	If the voters have to provide a GCIT email with abc123.gcit@rub.edu.bt format.	No error message.	Email Id accepted.	Pass

	Checks voters name / username.	If the voters have given a text input.	No error message.	Name/Username Accepted.	Pass
	Checks users' id.	If the given voters' id is of length exactly eight and above.	No error message.	Users' id accepted.	Pass
	Checks voters' password.	If the given voters password is of length exactly six and above.	No error message.	Voters' password accepted.	Pass
	Checks voters' confirm password.	If confirm password matches the password.	No error massage.	Voters' confirm password accepted.	Pass

Table 6.3: Test case 3

Testing case: 4 **Project name:** Tshogyen

Module: Functional Testing

Function specification: Voters login

Test objective: Successful Voters login

Test Case Title	**Description**	**Steps**	**Expected**	**Actual**	**Status**
Voters' login. Authenticate Successful login.	The registered voter should be able to successfully login.	Enter the valid credentials; email and password of the registered voter and click login.	Voter Dashboard should be displayed.	Home screen of voter dashboard is displayed.	Pass

Table 6.4: Test case 4

Testing case: 5 **Project name:** Tshogyen

Module: Functional Testing

Function specification: Candidates update and delete features

Test objective: Successful Candidates update and delete

Test Case Title	**Description**	**Steps**	**Expected**	**Actual**	**Status**
Update Candidates.	Admin can update the details of the candidates.	Hold on the card view of a specific candidate for two seconds. A dialog box pops up. Click on update. Modify / Change the candidate details. Click on update button.	Candidate's details updated.	Candidate's details updated. Message: Updated.	Pass
Delete Candidates.	Admin can delete the candidates.	Hold on the card view of a specific candidate for two seconds. A dialog box pops up. Click on delete and then data will be deleted permanently.	Candidates deleted permanently.	Candidates deleted permanently. Message: Deleted.	Pass

Table 6.5: Test case 5

Testing case: 6 **Project name:** Tshogyen

Module: Functional Testing

Function specification: Voting

Test objective: Successful Voting and correct vote count

Test Case Title	**Description**	**Steps**	**Expected**	**Actual**	**Status**
Vote	Registered voters can vote only once.	Click the vote button and click next.	Vote saved.	Vote saved and redirected to the next page. Message: Vote Successfully Saved.	Pass

Table 6.6: Test case 6

CONCLUSION

There is no use/implementation of online voting through mobile applications in RUB Colleges in Bhutan including the Gyelpozhing College of Information Technology. Voting in RUB college is carried out using the EVMs and paper ballots which proved to be useless in times of pandemic situations such as now. The pandemic proved that doing things online is more effective and convenient especially through the use of mobile applications. Similar voting online through mobile applications is also proven to be beneficiary. It has shown that it is advantageous for both voters as well as the organization and institution who is organizing and conducting the election.

"Tshogyen" is a mobile voting application developed to conduct GCIT councilor' selection in an easy, effective and efficient manner. It is an easy to use and user friendly application specifically designed for the purpose of electing councilor in Gyalpozhing College of Information Technology. It is built using Android Studio (software), XML (framework/design) and Java (programming language). This mobile voting application has numerous advantages over the traditional voting system. This application will manage voters through login and they can use their voting rights. The system will incorporate all the features of the voting system. The main motive of this application is to conduct elections easily, efficiently, error free and effectively without having to use physical machines like EVMs. In addition, using this application is cost efficient and it eliminates risk of human and mechanical errors. The result generation is very fast and accurate. The system is easily accessible and less time consuming.

ACHIEVEMENT

This mobile voting application is not a final product and needs many improvements but the result achieved so far is enough to conduct a decent voting process. And the achievements so far are as follows:

1. Successful registration of the candidates with validated details such as name, id, email, profile photo and the post they are competing for.
2. Only eligible voters (staff and students of GCIT) are able to cast the vote because while voter registration, the email field only accepts the GCIT college emails.
3. Successful login process of admin and voters.
4. Viewing, adding, updating, searching and deleting the candidates are successful.
5. While viewing manifestos, successfully redirected to the YouTube page where the manifestos of each candidate is uploaded.
6. Navigation throughout the application is accurate.
7. Multiple voting is not possible as the voting feature will automatically close after the whole voting process is over.
8. Application is fast in loading and response.
9. No error in vote count.
10. Voters will automatically be logged out of the application after 10 minutes of not being used for security and privacy purposes.
11. Successful logout process.

FUTURE WORKS

The development of this mobile voting application “Tshogyen” is not a final one as it needs some more additional features to make this application more effective and efficient. Some of the features that were planned in the beginning of the development of the application were not implemented due to the time restriction.

Some of the features that needs to be implemented in this application in the near future are as follows:

1. Date and Time: Admin being able to set election date and time limit for voting.
2. Notification: Send notifications to the voters when the voting time is enabled.
3. Result: Admin able to view results only after the election is over.

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