DESIGN AND DEVELOPMENT OF A SECURED ELECTRONIC FINGERPRINT VOTING SYSTEM

BY

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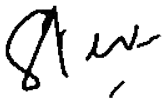

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ABSTRACT

This project is a mobile application development project for student final year project. This project will development a new E-Voting system on android mobile. The system of this project is aimed to replace the traditional voting method by introduce an E-voting system. This system can help people having an easy and fair voting system. All users can do their democracy decision by using this system. This project will use the fingerprint recognition to verify the voter identity to prevent fraud occur. The system also can further improve to make it become a voting system for election. This can solve a lot of election problem in our country, Malaysia. Such as, people lazy go to election center and people not willing to queue and wait for voting. Therefore, this project is not only designed for public informal use, and it is also able to use for formal and important vote event. There is some e-voting system in before, most of the system just improved the time consume for voting and security of voting result. But the voters still need go specific place and use specific device with specific time. However, there are some online e-voting systems also, but the security to prevent fraud has been ignored. This project needs to overcome those challenges and limitation to development a good e-voting system which are suitable for formal use and public use.

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LIST OF ABBREVIATIONS

PCA	Principal Component Analysis
LBPH	Local Binary Patterns Histograms
KNN	K-Nearest-Neighbor
SVC	Support Vector Clustering
CMOS	Complementary Metal Oxide Semiconductor
OTP	One-Time Password
SDK	Software Development Kit
API	Application Programming Interface
RAM	Random Access Memory
IC	Identity Card

Chapter 1
Introduction

In this chapter, the information, problem, objective, and scope for voting system will be discuss. This is because, there are a lot of voting system, but there also having some limitation. Therefore, in this project, a new secured electronic voting system will be developed and introduced to overcome the limitation or weakness of voting process. This e-voting system will be made in android and using fingerprint to authenticate which mean the system will run as a fingerprint mobile application.

1.1 Problem Statement and Motivation

Voting is a way that make peoples nowadays to have the right for make decision. The decision of every participant will be collected, and the final decision will make through the result of the vote. Voting is very common in our real life from deciding the lunch with friend up to election for the leader of the country. But there is some problem and issue to the voting system, especially for the traditional voting system.

The problems of the traditional manual voting system are following:
1. Mobility: In traditional voting system, the voters are required go to specific location to make their vote.
2. Time consuming: Besides from mobility, the voter also needs to spend the time on queueing at the vote station. In addition, a lot of time is needed to make the preparation and calculation result for voting.
3. Verifiability: Voters do not know whether their votes have been counted in the result or not.
4. Uniqueness: It cannot make sure that all voters only vote once in voting process.
5. Fairness: Because there may have some errors will occur, such as the error when calculate the result, the error when identification the voter, some voter not able to vote, some fake voters able to vote and some voter may make multiple votes

Besides, when these problems occur in government election for a country. That will make a big trouble to citizen and government. This is because the citizen might not agree to the result

which are loss of fairness and some citizens abandon to vote just because it is took a lot a time. Government needs to spend a lot of time and manpower during every election.

To overcome those problems, a biometric e-voting system can be solving it perfectly. The biometric identification is the most secure method to identity the voter. On voting day, the voter can use the e-voting system to make their vote at anyplace and anytime. But biometric identification is required to checking the voter is qualified or not, if the voter is not qualified, the system will deny this vote. Hence this system can solve those problem significantly, make the vote process become more accuracy, more secure and less time consume.

1.2 Objectives

The system of this project is aimed to replace the traditional voting method by introduce an E-voting system. This system can help people having an easy and fair voting system for their daily life. All users can do their democracy decision by using this system. The system will secure by biometric identification technique. The project objectives are as follow:

1. To provide user to vote in anytime and anyplace.
2. To prevent fraud issues occur during voting process.
3. To prevent fake and unaccepted vote.
4. To ensure the identity of user are real and accuracy.
5. To prevent identity theft for stealing user identity.

In order to achieve objective 1:

- An android mobile e-voting system will be designed and developed. This can lower the requirement of hardware. This is because android phone has the most market share.
- The android studio will be used to design and develop for this e-voting system.

In order to achieve objective 2,3:

- A two-layer security will be design and develop for this system. The user needs to register and login with verified real information. Besides, when the user wants to submit their vote, a fingerprint recognition is needed for biometric authentication.
- In addition, to perform the fingerprint recognition in this system, a minutiae-based algorithm will be used for fingerprint recognition. This algorithm can increase the accuracy for the fingerprint recognition.

In order to achieve objective 4,5:

- A phone authentication is required when user register an account. This is because the phone number is the unique id. This can make sure one phone number is register for one account only.
- The fingerprint authentication also will used when user registration and user information update.

1.3 Project Scope and Direction

E-voting system can save a lot of time and manpower for preparation period, user just only need to create a poll and invite voters to vote. When using e-voting system the voters no need to go anywhere to line up for voting, voter can use their smartphone to access the system for voting. Besides, the e-voting system also can get the accuracy result and statistics immediately after the voting end. In addition, some biometric identification can be adding into the system. For examples, fingerprint and face recognition is good method to ensure the identity of the voter. This is because biometric of everyone is different, therefore the fairness and security of voting result can be ensuring.

In this project, the fingerprint recognition will be used for authentication. This is because the fingerprint recognition is having more wide acceptance. Since it is not costly but secure and accuracy. Besides, the fingerprint recognition is stable, it does not have too much requirement for input image. Therefore, the user can use it in most of the situation.

Besides, the system will build as an android mobile application. This is because android is a mobile operating system which are open source and make developer able to build software for it. To perform the fingerprint recognition for our voting system, can easily use the function that most of the phone nowadays are having. Since the phone already having the fingerprint reader, then can use it to perform our biometric authentication.

In conclusion, this project will be using the fingerprint recognition to ensure the voting system is secure, fairness, and frauds avoid.

1.4 Contributions

Most of the E-voting system nowadays are less of convenience or less of security. This is because those system only provide local vote by using one device. However, some system able to vote through internet website but the identification and security are ignored. For this project, a combination of convenience and security voting system will be introduced. Due to the fingerprint recognition, the system is able to verify and confirm the voter's identity. This is because the fingerprint of everyone is unique, there is very less chance the fingerprint is getting fraud or change.

Since in this era, most of the people have a smartphone, a phone e-voting system application can be designed. Therefore, everyone can create their poll and vote in anytime. If the e-voting system can be use by government, the election for the government can be save a lot of cost and manpower for the country. Besides, people also can have their right to be an important role as a citizen for democracy.

Moreover, a lot of company especially big company which having a lot of employees, the employee can easily know the things organization doing and vote for their choice and opinion. Admin also can get result of vote instantly to know the opinion of all employees. But due to the COVID 19 and others sickness, this makes a lot of impact to our social life. To minimum the risk of getting sick, people need to keep a good social distance. But in traditional voting method, people need to gather and queue up to make their vote, this makes a lot of physical contacts within voters.

1.5 Report Organization

This report has 6 chapters: Chapter 1 Introduction, Chapter 2 Literature Review, Chapter 3 System Design, Chapter 4 System Implementation and Testing, Chapter 5 System Evaluation and Discussion, Chapter 6 Conclusion. Chapter 1 is to introduce the project which includes problem statement and motivation, objectives, project scope and direction, contribution and report organization. Chapter 2 is the literature review on some technique and existing applications in the market to evaluate the strengths and weaknesses. Chapter 3 is discussing the overall system design of this project. Chapter 4 discuss about the system functionality and the requirement. Chapter 5 discuss and evaluate the system. Lastly, Chapter is conclusion to the project, include project review, novelties and contributions, limitation, and future work for the system.

Chapter 2

Literature Review

Voting is a formal decision-making process for a group. Voting is very common to use in our daily life. The decision can make by calculate voting result and follow the majority voting. Voting has existed for long time for any kind of situation. In this chapter, the detail of different voting system and biometric method will be discussed.

2.1 Type of Voting Systems

There are two type of voting system can be classified:

1. *Paper based Voting*
2. *Electronic Voting*

There are some countries are keep using paper-based voting from the beginning until now, they have not tried to change the voting system, such as Malaysia, Singapore, Indonesia. There are also some countries after trying the e-voting system but reverted to paper-based voting (Lameez 2019). Such as Netherlands, Germany, Ireland. This is because they a lot of experiment show the e-voting system is not secure and not transparent enough. But there are some countries are still using e-voting system. Such as India, Brazil, Philippines. This is because the system can help a lot on time and cost, since there are huge number of voters, the voting process and counting process will be very difficult but can solve it easily by e-voting.

2.1.1 Paper based Voting

This is a traditional voting system which are existed for very long time. This method needs the voter go to the voting place in specified time. During voting, the voters stand in the booth and write down their choice then put it into a ballot box. But a lot of disadvantages in this method (Bronack n.d.). The voter must go to the voting place and spend their time to waiting in a queue for vote. A lot of manpower is also needed for anytime of the voting, for preparation before voting, for identify voter during voting, for calculate the result after voting. Besides, the result by this voting method will not totally accuracy for every time. This is because there are some chances to fraud and maybe some human mistake will occur. In addition, the cost and the time spent is the most important problem.

2.1.2 Electronic Voting

Electronic voting is also known as e-voting (Blanc 2007). E-voting is a voting method which are allow voter using electronic ways to submit their choice. Besides, the result of the voting can be calculated rapidly by system. There are many types of e-voting system. In common, there are two main types of e-voting system can be classified. First, an e-voting system which is required to go the voting place to using the electronic device for vote. Another one is remote e-voting through the internet which can allow voters make their vote from any location.

2.2 Types of biometric

Biometrics is a general term for describe either a characteristic or a process which able to recognize a person based on biological features. During the verification process, biometric system will check the identity of a person by matching with the sample which is stored in database. There are many types of biometrics that can perform for e-voting system (Ravi n.d.).

2.2.1 Face Recognition

The system can recognize a person by the facial image. In this technique, the facial image will be captured by the camera and matching with sample in database. The image captured can be highly noisy by affect by many things. For example, insufficient light will make the system unable to detect and recognize the person face completely. This is because, face recognition is a very difficult computing method due to a lot of factors like background image, facial expressions, angles and light. But by using this method, the process is very efficiency and high acceptance.

There are few algorithms and techniques found for face recognition:

1. *Eigen-face*

   The basic of the eigenfaces method is the Principal Component Analysis (PCA). The Sirovich and Kirby have used the Eigenfaces and PCA to show the face images efficiently (Sirovich & Kirby 1987). Besides, the Turk and Pentland applied the Eigenfaces to the face recognition issue (Turk & Pentland 1991). By using eigenface method, the characteristic features of the face are being extracted and the linear combination of the face representing data are created. The advantages of this method are it is easy to implement and high accuracy. But there also having some limitation,

such as the face are required to proper centered, the light, shadow and scale of face are sensitive.

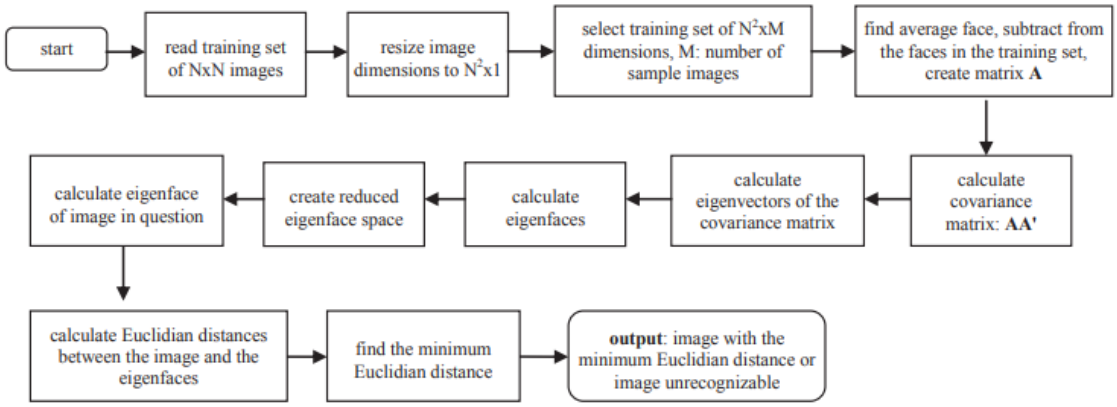


Figure 2.1: Flowchart of the Eigenfaces method algorithm
(Source: Face Recognition on Bag Locking Mechanism from http://eprints.utm.my/id/eprint/85263/1/MohamadHafisIzranIshak2019_FaceRecognitiononBagLocking.pdf)

2. LBPH

Local Binary Patterns Histograms (LBPH) is a simple and very efficient texture operator. This algorithm will label the image pixel by thresholding the neighborhood of each pixel and output the result as binary number. Deeba, Memom and their team are used the LBPH method for enhance the real-time face recognition system (Deeba, Memon, Dharejo, Ahmed & Ghaffar 2019). This method is very accurate and able to implement for real-life environment. But there is some limitation for it, the system cannot recognize the face when some head pose is made by user.

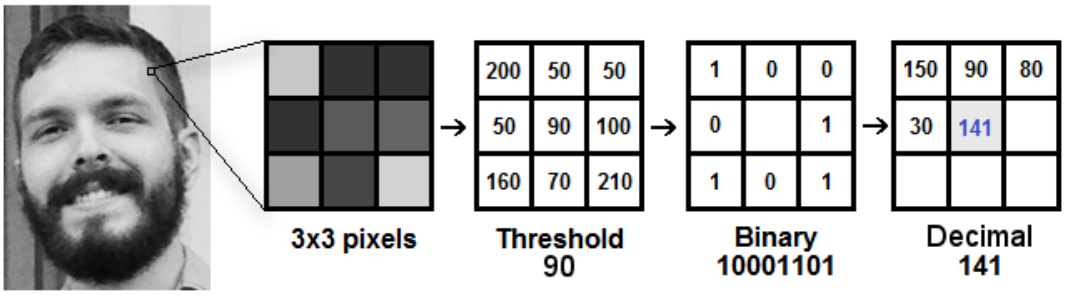


Figure 2.2: Procedure of LBPH method
(Source: Face Recognition: Understanding LBPH Algorithm from https://towardsdatascience.com/face-recognition-how-lbph-works-90ec258c3d6b)

2.2.2 Voice Recognition

Voice recognition is a technology that using a person's voice to verify their identity. This system is work by creating a voice print of the user and store in database. When the system wants to make the voice verification for user, then the system will be matching with the voice print in database. This is because everyone has their own unique sound. There are two main methods to done voice recognition: Text-independent and Text-dependent. Text-independent can allow user speech any content to perform the recognition. However, text-dependent is user only can use the same passphrases which are stored before to perform the recognition. But voice recognition is not suitable for every environment, especially noisy place. Because the input voice will be affected by the noise. Besides, the voice print of a person may change over time or affect by other reason. The security of voice recognition is also a big problem, since nowadays a lot of high technology will be a threat to this method. Such as machine learning and recording technology will make the system think it is the correct voice.

Voice recognition can perform by using classification algorithms. Mamyrbayev, Mekebayev and their team do the voice identification using classification algorithms (Mamyrbayev, Mekebayev, Turdalyuly, Oshanova, Medeni & Yessentay 2019)**.** They use few different algorithms such as:

1. Extra-Trees algorithm – To builds an ensemble of unpruned decision or regression trees.
2. K-Nearest-Neighbor (KNN) algorithm – To measure the distance between a query scenario and a set of scenarios in the data set.
3. Support Vector Clustering (SVC) algorithm – To solve a linearly separable and using binary classification.

2.2.3 Iris Recognition

Iris recognition is a process that using visible and near-infrared light to take a high-contrast photograph of a person's iris. Iris recognition measures the unique patterns in the colored circle of your eye to verify user identity. After the iris image is taken, the system will be compared with the templates which is stored in the database. Therefore, the identification will be done. Iris recognition can operate at long distance by improving the hardware and the system. The result of iris recognition can be accuracy since the iris is protected by our cornea, so it will not change and difficult to spoof. But this system only uses specific camera which are include IR light source and sensor.

Iris can perform by many different algorithms. Hendre, Parab and their team has done a comparison of iris biometric algorithms (Hendre, Parab, Kakad & Kamble 2016). Their compare some algorithm such as Avila, Tisse, Li Ma, Daughman.

1. Avila – the iris features were represented by fine to coarse approximations at different levels.
2. Tisse – It implements gradient decomposed half transform and analytic image concept to extract information for iris.
3. Li Ma – It decomposes the iris image into four levels by using 2-D Haar wavelet transform.
4. Daughman – It detects the inner and outer boundaries of iris and process.

2.2.4 Fingerprint Recognition

Fingerprint recognition is one of the methods to identify the identity of the person by using fingerprint reader and matching the fingerprints with database. Fingerprint recognition is the most well-known biometrics, a lot of smartphones nowadays are able to use this biometric method to unlock the phone. This is because fingerprint recognition is one of the high accurate biometric. Not only accurate, but the speed of fingerprint recognition is also very fast, and the performance is stable. There are exist few types of fingerprint reader hardware (Triggs R 2019):

1. Optical reader which are most common fingerprint reader. This reader is a digital camera that obtain a visual image of fingerprint. The Advantage of this reader is cheaper than others but it very easy to impact by dirty or marked fingers.
2. Capacitive reader (CMOS) which is using capacitors and thus electrical current to make up an image of the fingerprint. Advantage of this reader is no light is needed for read the fingerprint image. Besides, the reader is requiring a real fingerprint shape so make the reader is more secure.
3. Ultrasound reader which are using high frequency sound waves to penetrate the outer layer of the skin. This makes this reader can ignore those problem which will affect other readers. Such as dirt or scars will make the read fail. Therefore, the accuracy and security are better. But the price of this reader is much more expensive.
4. Thermal reader which are using sensor to sense the temperature on fingerprint ridges and valleys. But this reader will affect by the environment temperature.

Therefore, the fingerprint recognition can be easily to get the input image. Then the identify process be done.

2.2.5 Android Fingerprint Biometric Authentication

The Android Fingerprint authentication is available on Android version 6.0 Marshmallow (API 23) and higher. It provides the user register their fingerprint and save into system. The developer can easily add this function into the application and provide the fingerprint authenticate service for user. This can make improve to the security of application by adding an extra security defense.

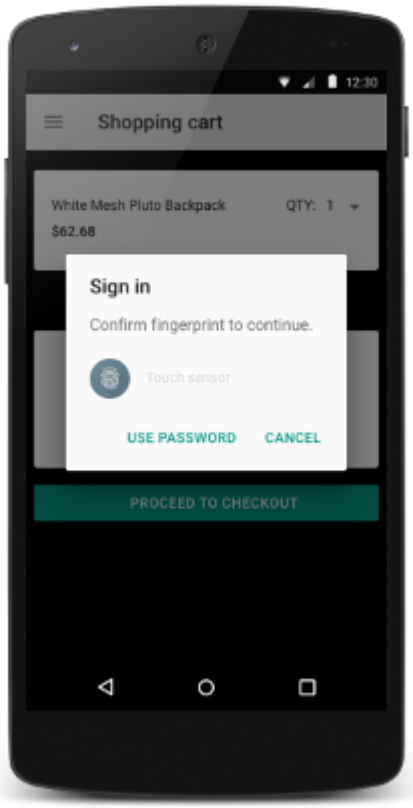


Figure 2.3: Android Fingerprint Authentication Sample

2.3 Comparative Fingerprint Voting System

There is some developer developed some E-voting system to replace the traditional voting system. After studied those report and paper, there are some advantage and disadvantage for those techniques and design their done in the E-voting system.

In first paper, Mobile Voting Using Finger Print Authentication (Jumb, Martin, Figer & Rebello 2015), this paper has recorded down the OTP technique and Minutiae Algorithm as fingerprint authentication technique. By using these two techniques, the system can have better secure and also less time consuming, inexpensive, wide acceptance for the fingerprint recognition. But the fingerprint image cannot be poor quality, it will make unsuccessful for recognition.

In second paper, Secured E-voting System Using Two-factor Biometric Authentication (Komatineni & Lingala n.d.), the system in this paper is using Eigen face recognition algorithm and Minutiae algorithm for fingerprint recognition. In this system, the user has two recognition method to choose for authentication. This makes user can choose their prefer method to authentication and give another choice for some user which having physical problem or environment problem. But this make there is more images need to store in database.

In third paper, E-Voting System Using Visual Crytography & Secure Multi-party Computation (Naidu, Kharat, Teckade, Mendhe & Magade n.d.), the techniques used in this system is Secret sharing algorithm and Minutia extraction. This make the system become more secure, because the data is separate store in user database and system database, system need both of the data to process the authentication. Therefore, there is less chance to fraud or steal data from the system. But, if one of the data is missing, the system will be unavailable, it cannot be process.

Here are some report and paper which are related to E-voting system:

Paper Title	**Author's Name, Years**	**Technique Used**	**Advantage**	**Disadvantage**
Mobile Voting Using Finger Print Authentication	Jumb, Martin, Figer & Rebello 2015	OTP, Minutiae Algorithm	Inexpensive, Less time consuming, Wide acceptance, Better secure	Cannot recognize poor quality fingerprint images
Secured E-voting System Using Two-factor Biometric Authentication	Komatineni & Lingala n.d.	Eigen face recognition algorithm, Minutiae algorithm	Two choices for authentication, Less time consuming	High cost, more data to store
E-Voting System Using Visual Cryptography & Secure Multi-party Computation	Naidu, Kharat, Teckade, Mendhe & Magade n.d.	Secret sharing algorithm, Minutia extraction	More secure	Unavailable when one share of data lost.

Table 2.1: Compare of fingerprint voting system

2.4 Compare Existing E-voting System Application

There are few existing E-voting System Application which can easily download from Android Google Play Store. For these applications, all of them are not using any biometric authentication to increase the security and fairness of vote.

For the first application, Easy Voting. In this application, the user can create vote or vote easily, this is because the design of user interface is very simple and easily to understand. Besides, the system also provides the function for viewing history result. But the system only provides very less selection when setup the vote, and all voters need to vote by using one device.

Second application for e-voting is Pollie. This application provides a lot of function to user. For example, the system can register an account to sign in, a lot of setting can be setting when creating new vote, user able to share the vote link to others user, analytics for the result. Besides, the system having the fraud detection function to reduce the fraud affect to the result. The application is designed with very clear and nice user interface. But, when the user register for the account, there are not any real information checking to the user, this will allow someone using fake information to participate the vote process.

Third application is Poll for All. This application has very beautiful user interface, it has a lot of function also, most of the function is same with previous application (Pollie), but it able to create QR code and multiple languages is provided, this makes more user friendly. In addition, the system has IP detection technique for non-register voter, this can prevent one user with duplicate vote. Moreover, the techniques reCAPTCHA is used for fraud protection. But this application also does not have any real information register or biometric authentication to provide stronger security for system.

There is some e-voting software for android mobile application:

Application Name	**Functions**	**User interface**	**Advantages**	**Disadvantages**
Easy Voting	Create new vote, View history result	Very Simple	Very easy to understand and use	Less selection for setup, Need to vote by using one device
Pollie	Create new vote, Account sign in and sign up, Flexible setting, Fraud detection, Shareable vote link, Analytics for result, Reset all vote	Clearly and nice design with navigation menu and button	Can using website to vote by entering the shared link, Easy share by clicking the share button, Can see the live time vote amount and percentage, Can setting time period for voting	No high secure authentication method is using, Anyone can make vote with fake information
Poll for All	Create new vote, View created vote, View vote history, Account sign in and sign up, Flexible setting, Fraud protection, Shareable link and QR code, multiple languages provided	Beautiful design	Can using website to vote by entering the shared link and QR code, IP detection for non-register voter to avoid fraud, reCAPTCHA for fraud protection, Facebook registration for fraud protection, Able to change vote	No high secure authentication method is using, The fraud protection is not strong enough

Table 2.2: Compare existing android voting application

2.5 Conclusion

After reviewing those related method or technologies for E-voting system. This project can refer the advantages and limitation to decide what method and which technology to use. Especially for the secure part of the system, a biometric authentication can be used to reduce the fraud chance and improve the fairness of vote.

Chapter 3
System Design

In this chapter, the method used for this software development will be discuss. Decide a good and suitable development method is very important to development of new project.

3.1 Design Specifications

3.1.1 Development Method

In this project, a useful and secure e-voting system will be introduced. This project needs a lot of method and technique to make the system achieve the target. For the system in this project, this project going to develop an android software that able to use by smartphone which are match requirements. A fingerprint recognition for biometric authentication also will be used in this system.

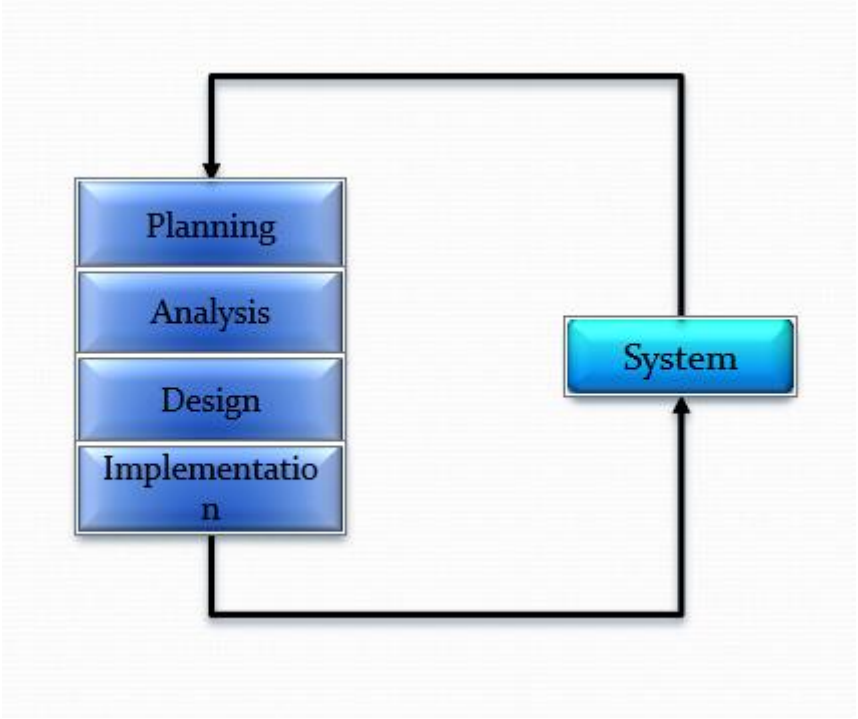


Figure 3.1: Agile Development flow diagram

To achieve the target, this project is using the Agile Development with Extreme Programming method. This is because by using this method, the system planning and design able to change at any point during the project life. This method is better and more realistic than fully planning all the things, it is very hard to control everything during the project period.

By using this method, only a quick planning and simple analysis is needed in begin of project. After that, perform the system design and implementation phases iteratively. Besides,

when any problem is occurred or any changes of requirement, the system can easily start a new cycle to improve the system.

3.1.2 Tools to use

Hardware

Operating System	Windows 10 Pro 64-bit
Processor	AMD Ryzen 3 2200G with Radeon Vega Graphics @ 3.50 GHz
RAM	16GB DDR4-2400MHz
Graphic Card	NVIDIA GeForce GTX 1050 Ti

Table 3.1: Desktop Hardware Specification

Software

1. Android Studio
2. Android Firebase (Website)

3.1.3 System Planning

System planning is a very important part to start every project, especially development a new software system. In the planning phase of a project, the project will be evaluated. The goal, outcome and requirements of the system will be identified. This can make the project member have a basic understanding about system and user requirements.

Besides, the project management also a part of planning phase. The work plan and project schedule will be decided. To ensure project member can work effectively with the plan. Therefore, system planning should clearly define the scope and purpose of the project to make sure the project can work smoothly.

In this project, a new fingerprint e-voting system is planned to be develop. For the system, it should be able to perform basic voting function with biometric authentication. In addition, the system will develop as a mobile android application to make user can use it anytime and anyplace.

3.1.4 User Requirements

- User shall read and understand the vote title and option.
- User shall make a choice for the vote.
- User shall use fingerprint to authenticate.

The functional requirement of this project will be the system need to provide basic function of voting system such as create voting event, vote, calculate result, show result. Moreover, the system shall be able to authenticate the user identity when user try to login and fingerprint biometric authentication when submitting vote. In addition, the user's phone number is required when register, after that the system should send a one-time code to user's phone by SMS message.

The non-functional requirement of this system will be the security of the system and the fairness of voting should be secure. The system of this project will be using biometric to achieve it. Besides, the mobility is also one of the non-functional requirements of this project. This is because the system needs to provide user to use it anywhere and anytime. Not only that, but the system should also have good performance to perform any function with only using low usage. This can make the application can run on more devices.

3.1.5 System Performance Definition

In this project, the system performance should be very fast and stable, because this system should make user can vote in a very fast and easy way on anytime anywhere. Besides, system need to stable. This is because the system should be able to perform a lot of users to vote in simultaneously. Moreover, the system needs to be secure and ensure they is no fraud of voting is occurred. Lastly, the system should be able to display the result immediately after the voting process end.

3.1.6 Verification Plan

For verification plan of the project, it will be using testing method to verification for this project. First, the Unit testing method is using to test functionality of every object. This can make sure every function in the system is able to work nicely.

Moreover, the system test will be performed to conduct a complete run of the system with testing every function of the system. The test also can compare recorded input with system output. For example, random times of vote and record down each time of vote manually, after this check the system result and manual result is same or not.

Lastly, the agile testing should be performed to repeat the cycle of agile development methodology. Since the agile development methodology is used for this project, hence any fix and improvement for the software can keep occur after agile testing.

3.1.6 System Analysis

The system analysis is to research and understanding the existing system. To learn how the existing system operates, function and business requirement. During this phase, the project goals are converted into system functions and requirements. Apply the requirement gathering techniques such as interview, questionnaire, observation, report inspections and so on. This can investigate and define new requirements for the project to develop a concept for new system.

In this project, the new system uses the fingerprint as biometric authentication for the voting system. This can solve the identity fraud problem of voting system. Besides, the system will develop as mobile application with android studio. Nowadays, most of the phone having fingerprint scanner, so can easily perform the fingerprint authentication for the system.

3.2 System Design

3.2.1 Overview

The fingerprint e-voting system will be designed for this project. The system is planned and designed to developed as mobile android application. The design of the application will discuss in this sub-chapter.

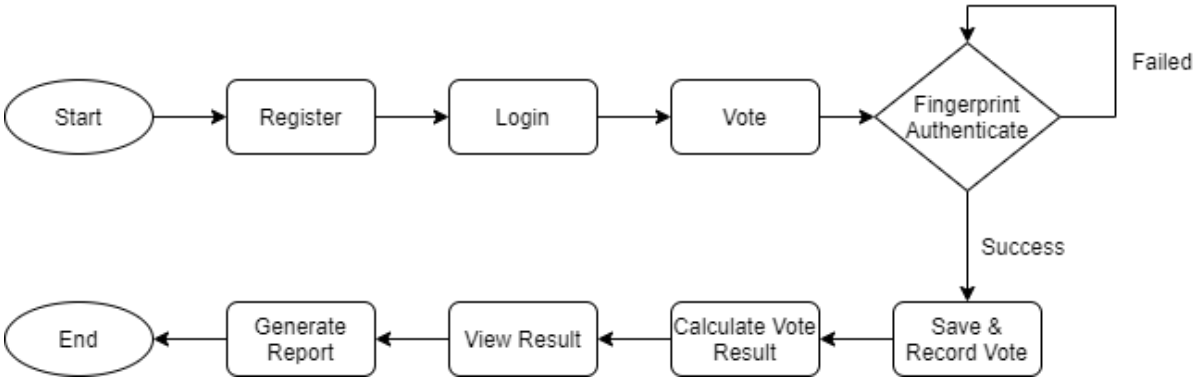


Figure 3.2: System Overview Flow Chart

The flow of the system should start on login or register of user. After that, a home page will be displayed, the user can select what to perform in this page. If user want to join a vote event, the user needs to perform a fingerprint authentication before submitting the vote. If the authentication is successful, the vote of user will be record and save into database. When the vote event closed, the system will calculate the vote result and generate a report.

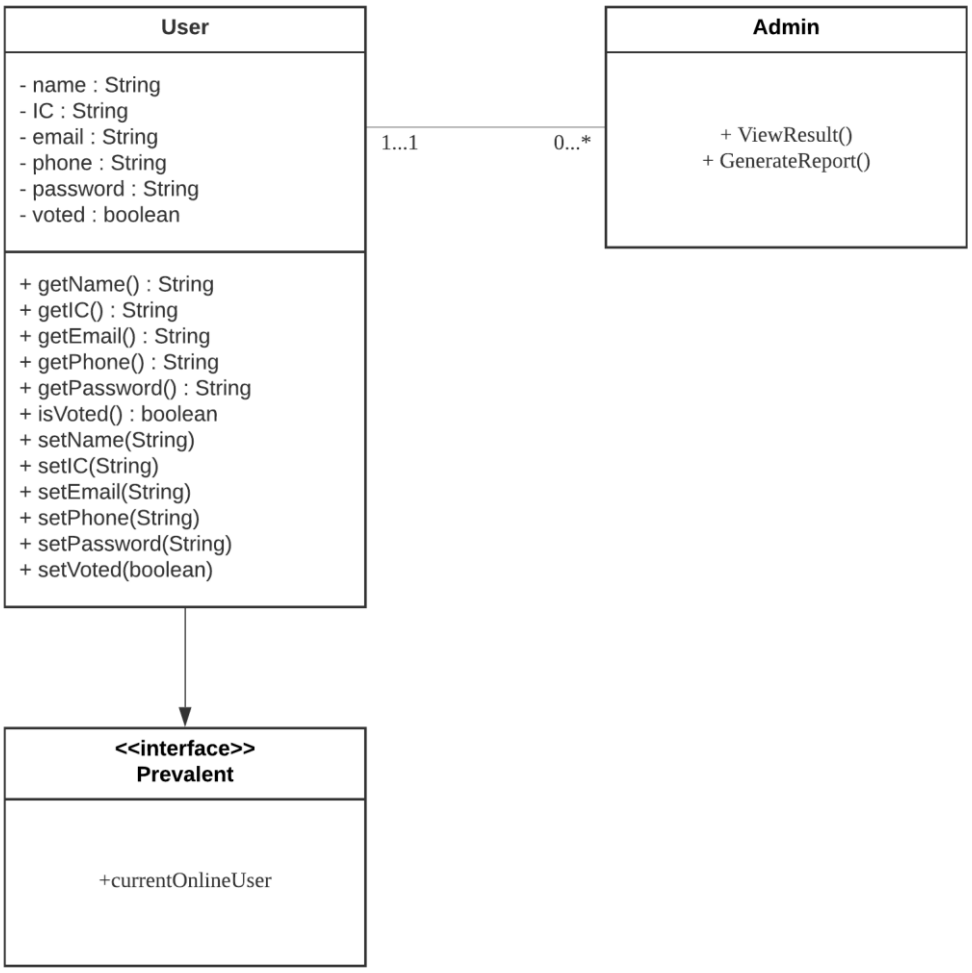


Figure 3.3: Class Diagram

The main class of this system is User class, it has all important information of user. The database will store that information such as user data and vote result.

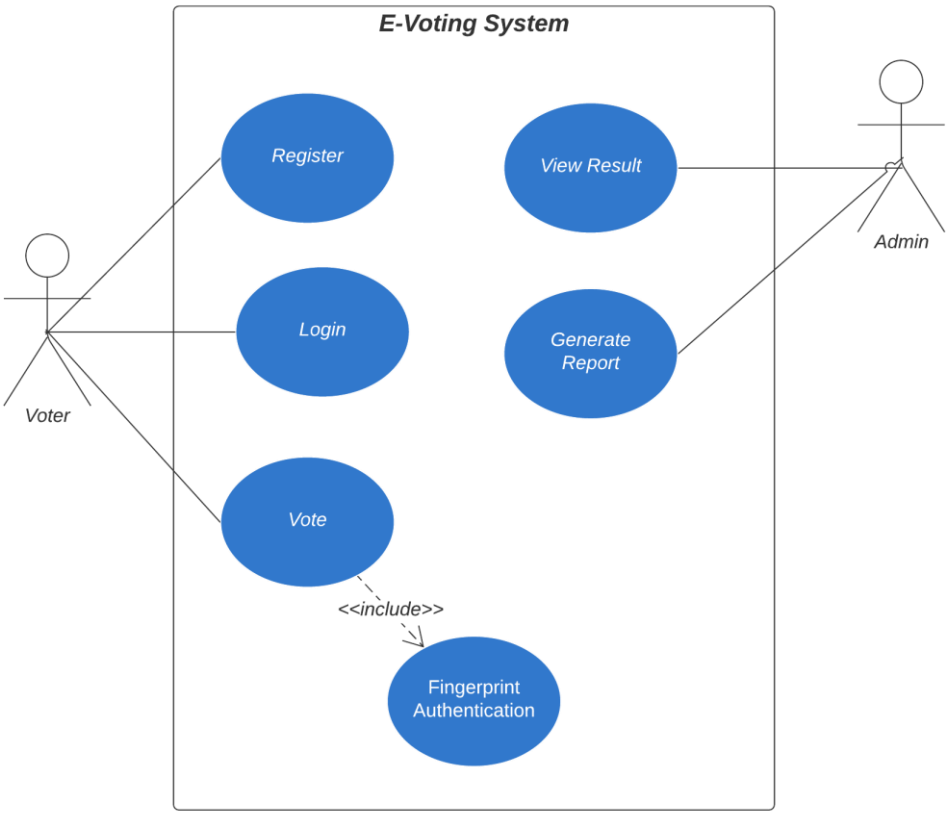


Figure 3.4: Use Case Diagram

There are some functions and modules which are designed for this system. The user is able to perform all of the function, but there is some perform are need fingerprint recognition.

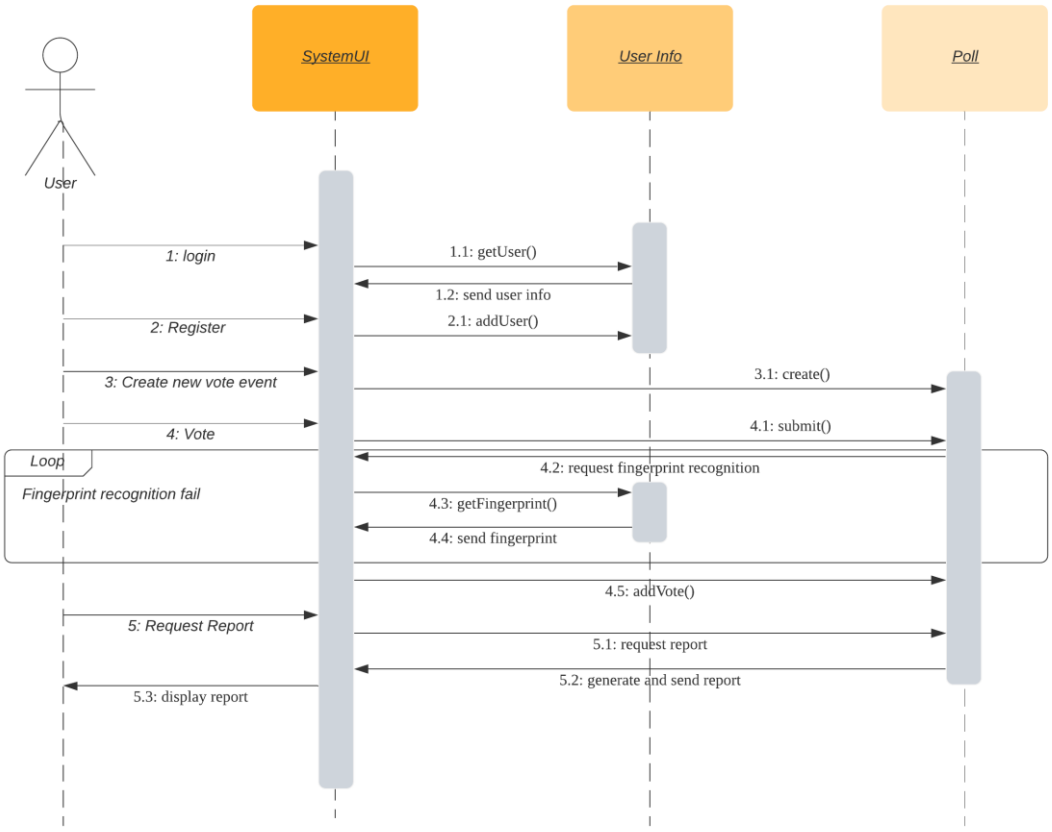


Figure 3.5: Sequence Diagram

The user interacts with the system UI, then the system UI will interact will database to get or update the database information. After that, report back or display to the user.

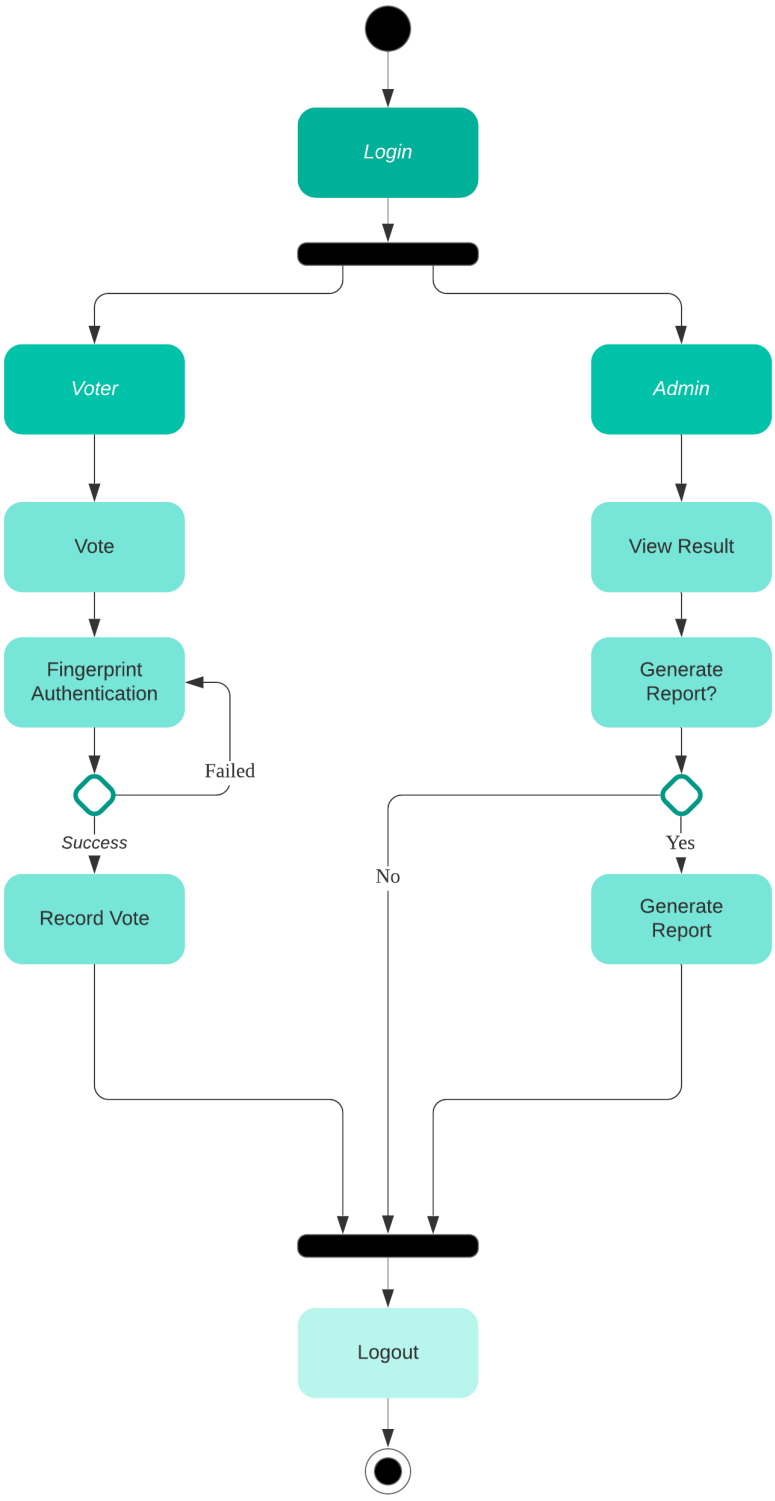
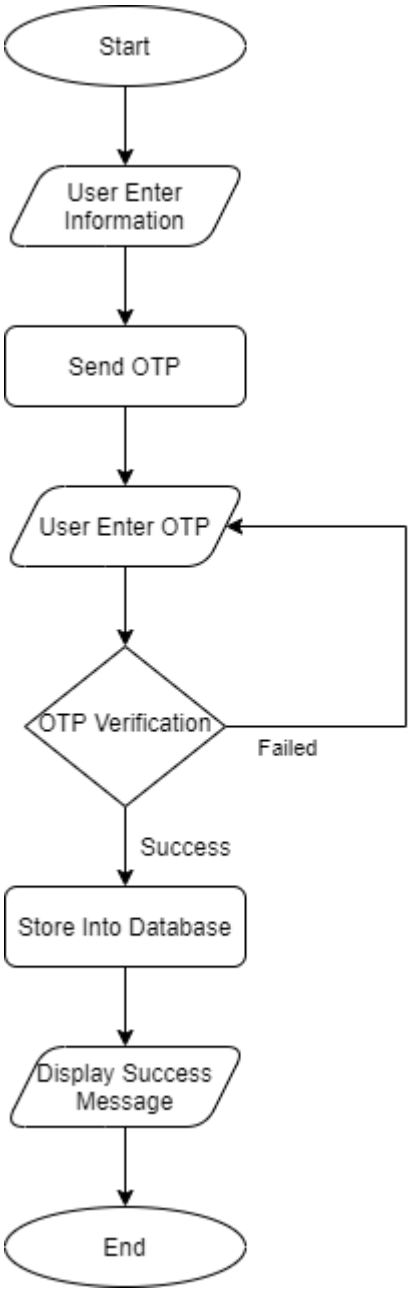


Figure 3.6: Activity Diagram

After login, system will detect it is voter or admin. The voter able to make their vote and verify by fingerprint authentication, the vote only recorded when fingerprint authentication is successful. The admin able to view the vote result and can choose either generate report or not.

3.2.2 Register/ Login



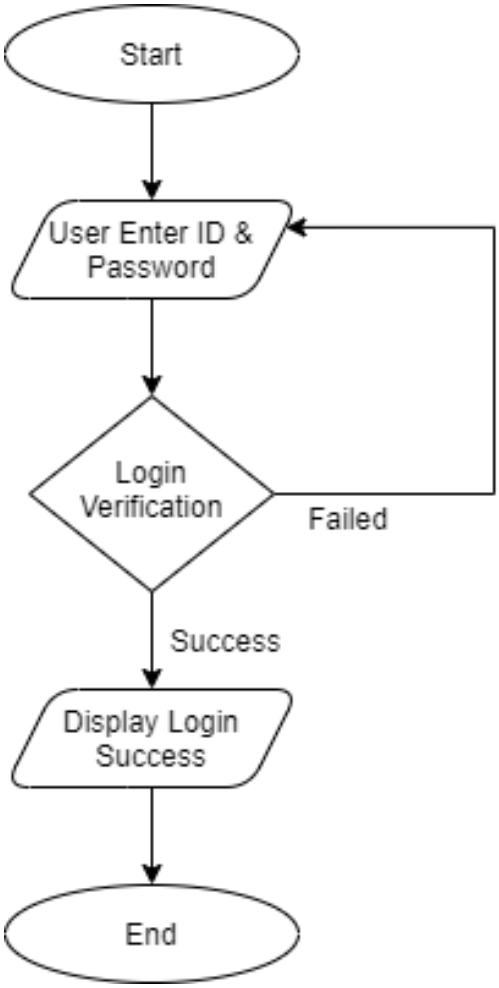


Figure 3.7: Register Flowchart *Figure 3.8: Login Flowchart*

All user needs to register an account with real information, a validation will be done to confirm the identity of user and OTP code is required. After this, the system will store the user information. Every user needs to login with own account. Besides, the fingerprint of user also needs to register into the system.

3.2.3 Vote

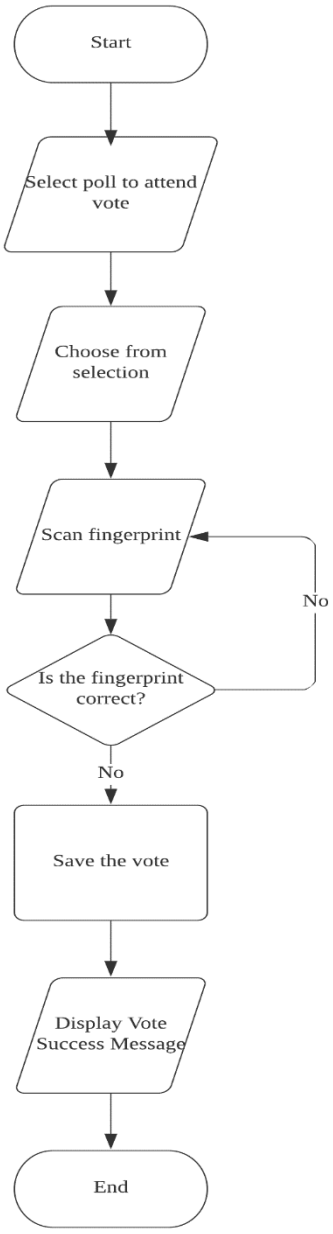


Figure 3.9: Vote Flowchart

For the user to join vote, user need to select their choice and submit the vote. Afterward, the system will ask for fingerprint verification.

3.2.4 Authenticate

The system will request user fingerprint to perform a fingerprint recognition for authenticate the identity of the user. This can make sure no fraud occurs. If user fail the fingerprint recognition, the system will loop back and ask user to scan fingerprint again.

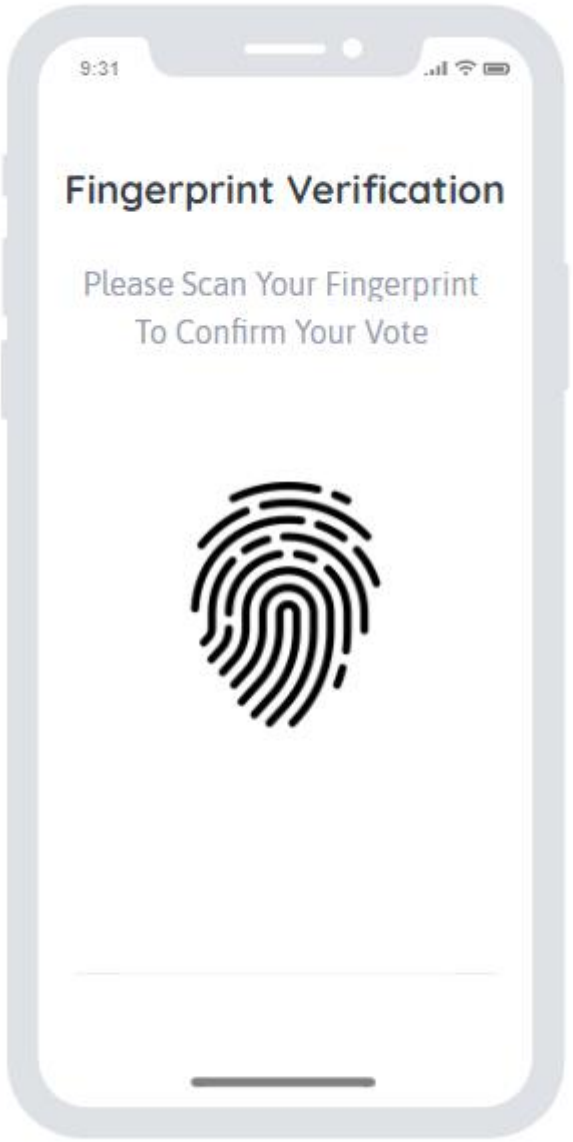


Figure 3.10: Fingerprint Verification

3.2.5 Save & Record Vote

Only after user success the fingerprint recognition, the system starts to record down the vote and store into database.

3.2.6 Calculate Vote Result

After the voting process is closed, the system will calculate the result of the vote. System will only calculate those votes which are record and save into database.

3.2.7 View Result

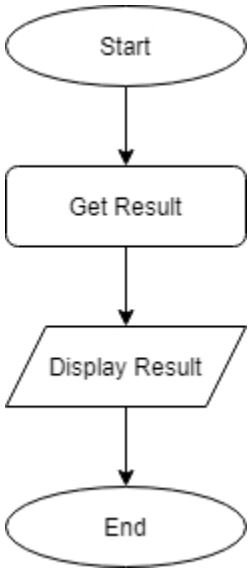


Figure 3.11: View Result Flowchart

After user select which poll to view the result, the system will get the result from real time database and display to user.

3.2.8 Generate Statistics/Report

The system will generate some statistics for the result of the vote, such as bar chart, pie chart and so on. After this, system will send and display a report to the admin or vote creator.

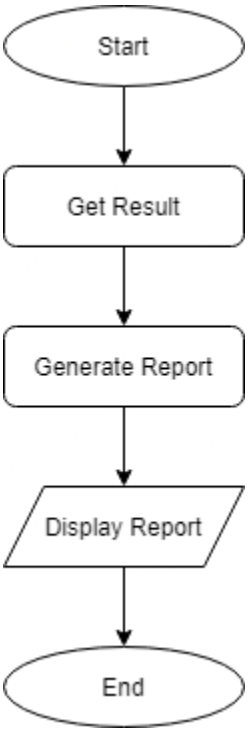


Figure 3.12: Generate Report Flowchart

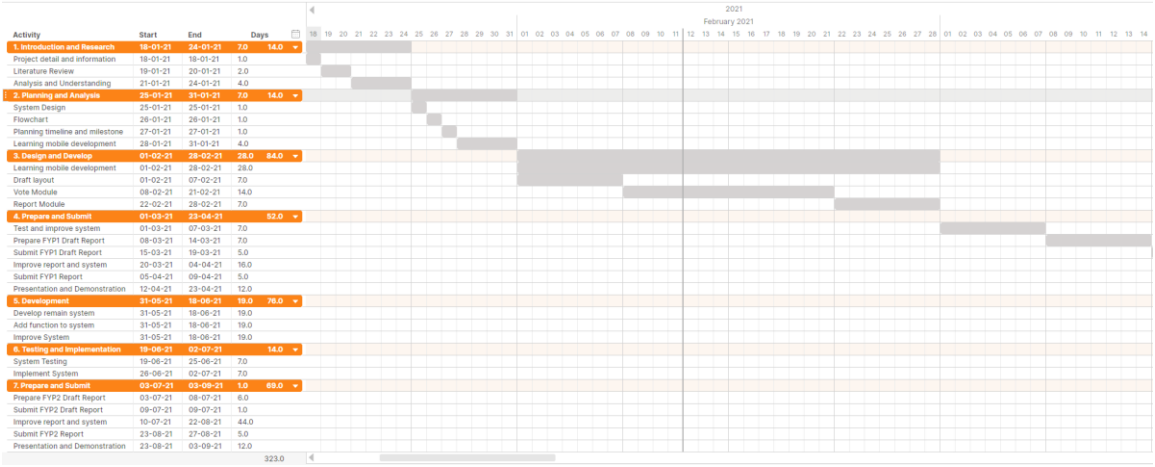
3.3 Implementation Issues and Challenges

There have a lot of issues and challenges that need to face when developing a new software. In this project, there have three main issues and challenges. First, the software needs to perform in good condition. But the system might need to perform a lot of voting process and calculation on the same time, the performance and speed will be the key point. Therefore, this project needs to make sure the software is nicely programmed.

Another issues and challenges are the security and fraud problem. Since the voting process need to be very fair to everyone, need to make sure everyone can perform their right to vote, to choose. So, the system must be recorded all the choice and prevent any fraud occur.

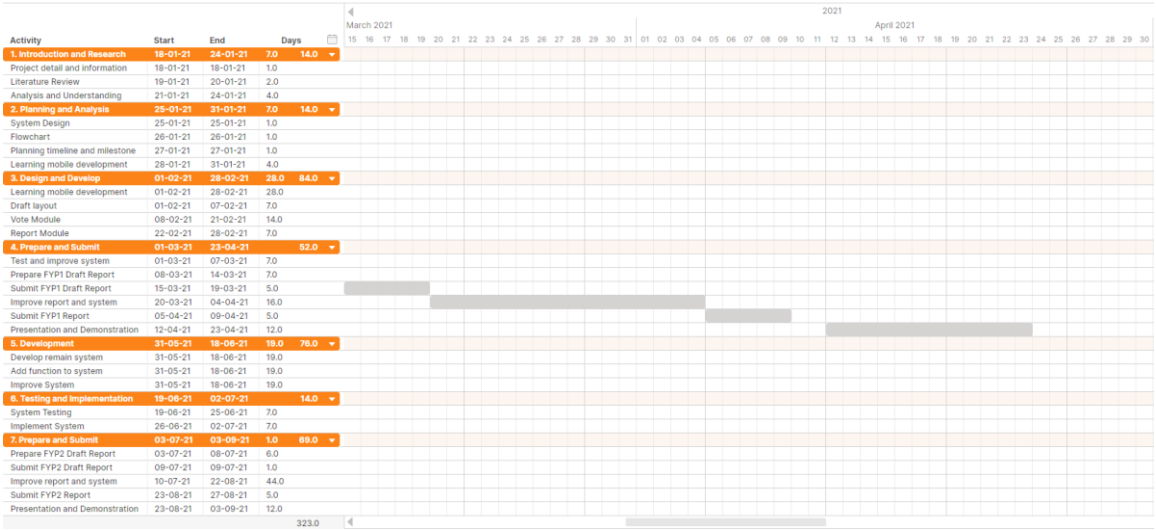
In addition, the fraud of voting process has few ways, but using other's identity to vote and duplicate vote is a very big issue, this is because this will make some people losing their right to choose and losing the fairness of the vote. Therefore, this system going to use fingerprint recognition to authenticate the identity of the voters. But to perform fingerprint recognition need to be having a very powerful algorithm. Hence, the algorithm for fingerprint recognition will be the big challenge to this project.

3.4 Timeline



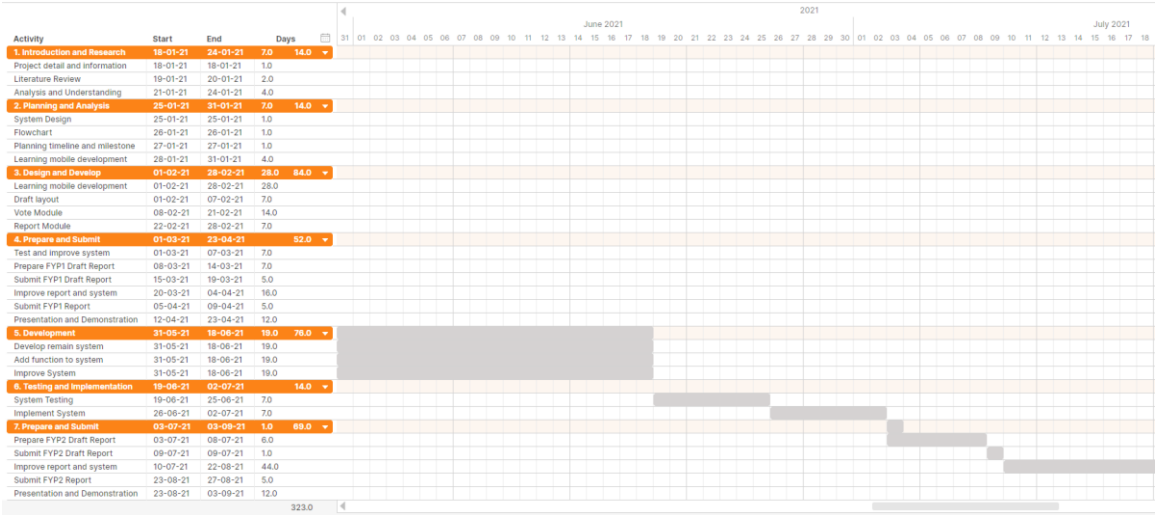
Activity	Start	End	Days	
1. Introduction and Research	18-01-21	24-01-21	7.0	14.0
Project detail and information	18-01-21	18-01-21	1.0	
Literature Review	19-01-21	20-01-21	2.0	
Analysis and Understanding	21-01-21	24-01-21	4.0	
2. Planning and Analysis	25-01-21	31-01-21	7.0	14.0
System Design	25-01-21	25-01-21	1.0	
Flowchart	26-01-21	26-01-21	1.0	
Planning timeline and milestone	27-01-21	27-01-21	1.0	
Learning mobile development	28-01-21	31-01-21	4.0	
3. Design and Develop	01-02-21	28-02-21	28.0	84.0
Learning mobile development	01-02-21	28-02-21	28.0	
Draft layout	01-02-21	07-02-21	7.0	
Vote Module	08-02-21	21-02-21	14.0	
Report Module	22-02-21	28-02-21	7.0	
4. Prepare and Submit	01-03-21	23-04-21		52.0
Test and improve system	01-03-21	07-03-21	7.0	
Prepare FYP1 Draft Report	08-03-21	14-03-21	7.0	
Submit FYP1 Draft Report	15-03-21	19-03-21	5.0	
Improve report and system	20-03-21	04-04-21	16.0	
Submit FYP1 Report	05-04-21	09-04-21	5.0	
Presentation and Demonstration	12-04-21	23-04-21	12.0	
5. Development	31-05-21	18-06-21	19.0	76.0
Develop remain system	31-05-21	18-06-21	19.0	
Add function to system	31-05-21	18-06-21	19.0	
Improve System	31-05-21	18-06-21	19.0	
6. Testing and Implementation	19-06-21	02-07-21		14.0
System Testing	19-06-21	25-06-21	7.0	
Implement System	26-06-21	02-07-21	7.0	
7. Prepare and Submit	03-07-21	03-09-21	1.0	69.0
Prepare FYP2 Draft Report	03-07-21	08-07-21	6.0	
Submit FYP2 Draft Report	09-07-21	09-07-21	1.0	
Improve report and system	10-07-21	22-08-21	44.0	
Submit FYP2 Report	23-08-21	27-08-21	5.0	
Presentation and Demonstration	23-08-21	03-09-21	12.0	
			323.0	

Figure 3.13: Gantt Chart 1



Activity	Start	End	Days	
1. Introduction and Research	18-01-21	24-01-21	7.0	14.0
Project detail and information	18-01-21	18-01-21	1.0	
Literature Review	19-01-21	20-01-21	2.0	
Analysis and Understanding	21-01-21	24-01-21	4.0	
2. Planning and Analysis	25-01-21	31-01-21	7.0	14.0
System Design	25-01-21	25-01-21	1.0	
Flowchart	26-01-21	26-01-21	1.0	
Planning timeline and milestone	27-01-21	27-01-21	1.0	
Learning mobile development	28-01-21	31-01-21	4.0	
3. Design and Develop	01-02-21	28-02-21	28.0	84.0
Learning mobile development	01-02-21	28-02-21	28.0	
Draft layout	01-02-21	07-02-21	7.0	
Vote Module	08-02-21	21-02-21	14.0	
Report Module	22-02-21	28-02-21	7.0	
4. Prepare and Submit	01-03-21	23-04-21		52.0
Test and improve system	01-03-21	07-03-21	7.0	
Prepare FYP1 Draft Report	08-03-21	14-03-21	7.0	
Submit FYP1 Draft Report	15-03-21	19-03-21	5.0	
Improve report and system	20-03-21	04-04-21	16.0	
Submit FYP1 Report	05-04-21	09-04-21	5.0	
Presentation and Demonstration	12-04-21	23-04-21	12.0	
5. Development	31-05-21	18-06-21	19.0	76.0
Develop remain system	31-05-21	18-06-21	19.0	
Add function to system	31-05-21	18-06-21	19.0	
Improve System	31-05-21	18-06-21	19.0	
6. Testing and Implementation	19-06-21	02-07-21		14.0
System Testing	19-06-21	25-06-21	7.0	
Implement System	26-06-21	02-07-21	7.0	
7. Prepare and Submit	03-07-21	03-09-21	1.0	69.0
Prepare FYP2 Draft Report	03-07-21	08-07-21	6.0	
Submit FYP2 Draft Report	09-07-21	09-07-21	1.0	
Improve report and system	10-07-21	22-08-21	44.0	
Submit FYP2 Report	23-08-21	27-08-21	5.0	
Presentation and Demonstration	23-08-21	03-09-21	12.0	
			323.0	

Figure 3.14: Gantt Chart 2



Activity	Start	End	Days	
1. Introduction and Research	18-01-21	24-01-21	7.0	14.0
Project detail and information	18-01-21	18-01-21	1.0	
Literature Review	19-01-21	20-01-21	2.0	
Analysis and Understanding	21-01-21	24-01-21	4.0	
2. Planning and Analysis	25-01-21	31-01-21	7.0	14.0
System Design	25-01-21	25-01-21	1.0	
Flowchart	26-01-21	26-01-21	1.0	
Planning timeline and milestone	27-01-21	27-01-21	1.0	
Learning mobile development	28-01-21	31-01-21	4.0	
3. Design and Develop	01-02-21	28-02-21	28.0	84.0
Learning mobile development	01-02-21	28-02-21	28.0	
Draft layout	01-02-21	07-02-21	7.0	
Vote Module	08-02-21	21-02-21	14.0	
Report Module	22-02-21	28-02-21	7.0	
4. Prepare and Submit	01-03-21	23-04-21		52.0
Test and improve system	01-03-21	07-03-21	7.0	
Prepare FYP1 Draft Report	08-03-21	14-03-21	7.0	
Submit FYP1 Draft Report	15-03-21	19-03-21	5.0	
Improve report and system	20-03-21	04-04-21	16.0	
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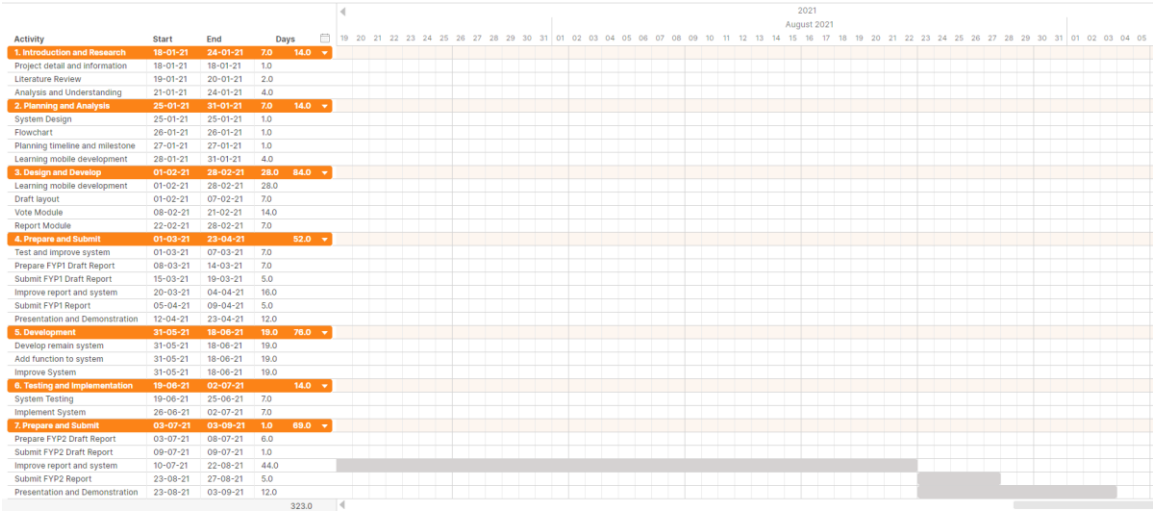
Add function to system	31-05-21	18-06-21	19.0	
Improve System	31-05-21	18-06-21	19.0	
6. Testing and Implementation	19-06-21	02-07-21		14.0
System Testing	19-06-21	25-06-21	7.0	
Implement System	26-06-21	02-07-21	7.0	
7. Prepare and Submit	03-07-21	03-09-21	1.0	69.0
Prepare FYP2 Draft Report	03-07-21	08-07-21	6.0	
Submit FYP2 Draft Report	09-07-21	09-07-21	1.0	
Improve report and system	10-07-21	22-08-21	44.0	
Submit FYP2 Report	23-08-21	27-08-21	5.0	
Presentation and Demonstration	23-08-21	03-09-21	12.0	
			323.0	

Figure 3.15: Gantt Chart 3



Activity	Start	End	Days	
1. Introduction and Research	18-01-21	24-01-21	7.0	14.0
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Analysis and Understanding	21-01-21	24-01-21	4.0	
2. Planning and Analysis	25-01-21	31-01-21	7.0	14.0
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Implement System	26-06-21	02-07-21	7.0	
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Submit FYP2 Report	23-08-21	27-08-21	5.0	
Presentation and Demonstration	23-08-21	03-09-21	12.0	
			323.0	

Figure 3.16: Gantt Chart 4

3.5 Conclusion

In a nutshell, the system in this project will be a fingerprint authentication E-voting system which are based on mobile android application and every user can use it on anytime and anyplace. Hopefully this proposed project can successfully develop and use by people.

Chapter 4

System Implementation and Testing

In this chapter, the work done, and result of system will be discussing. The part of the application which include Authentication is register, login, vote and etc. The system using OTP, Token, IC image and fingerprint for Authentication of the system to provide more security and less fraud for voting system.

4.1 User

4.1.1 Register

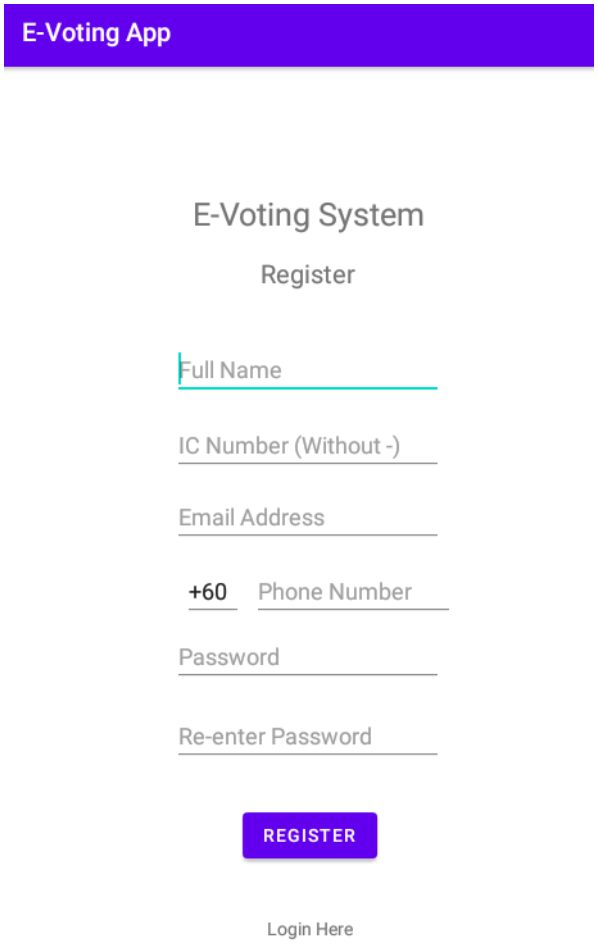


Figure 4.1: Register Page

This is the first step to do when the user wants to register as a voter. The user needs to provide real information, the admin will make a validation for the information of voter. Only validated voter is able to vote. Besides, the system will be based on the IC number to prevent duplicate register of the user.

4.1.1.1 OTP

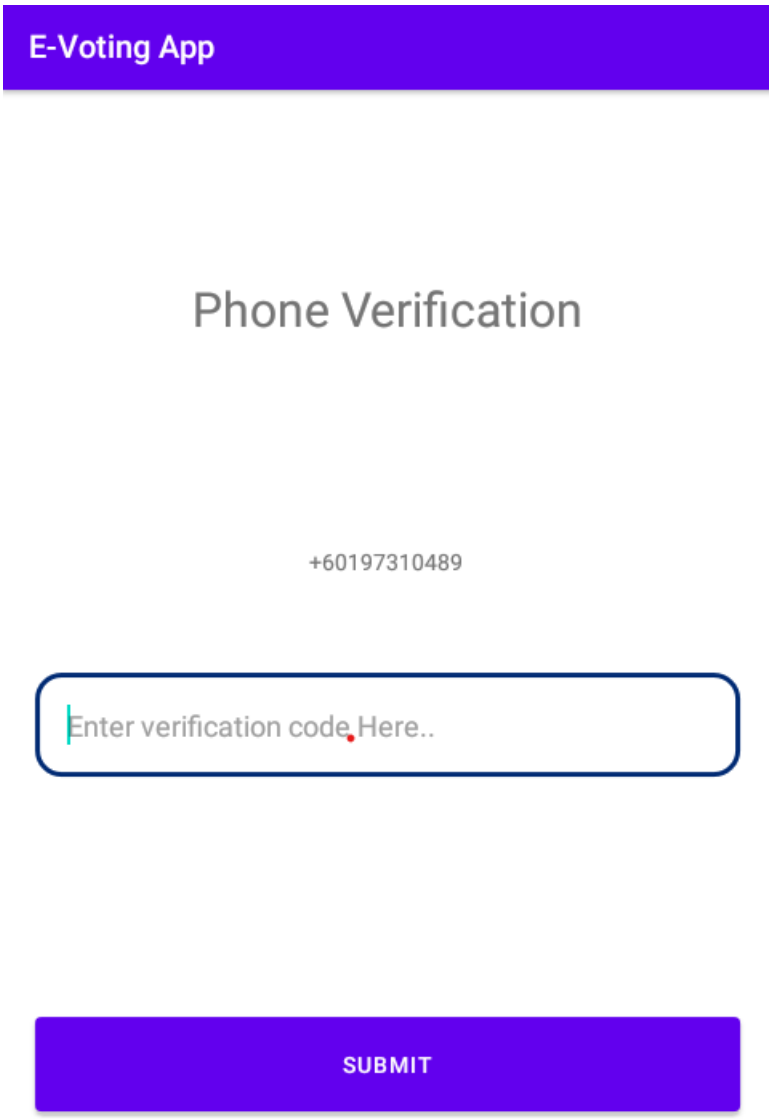


Figure 4.2: OTP Page

After key in all information and click the register button, the system will come to this page. The system will send an OTP verification code to user phone, to make sure the phone number is correct, and the person register is really own the phone number.

4.1.1.2 Upload Image

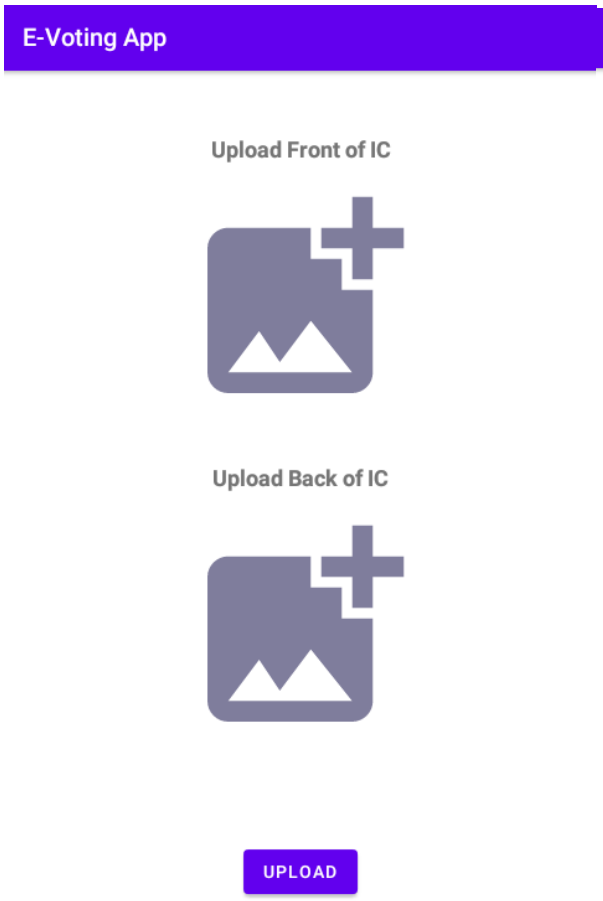


Figure 4.3: Upload IC Page

Figure 4.4: Upload Selfie Page

User needs to upload their IC picture and a selfie picture with taking IC.

4.1.1.3 Token

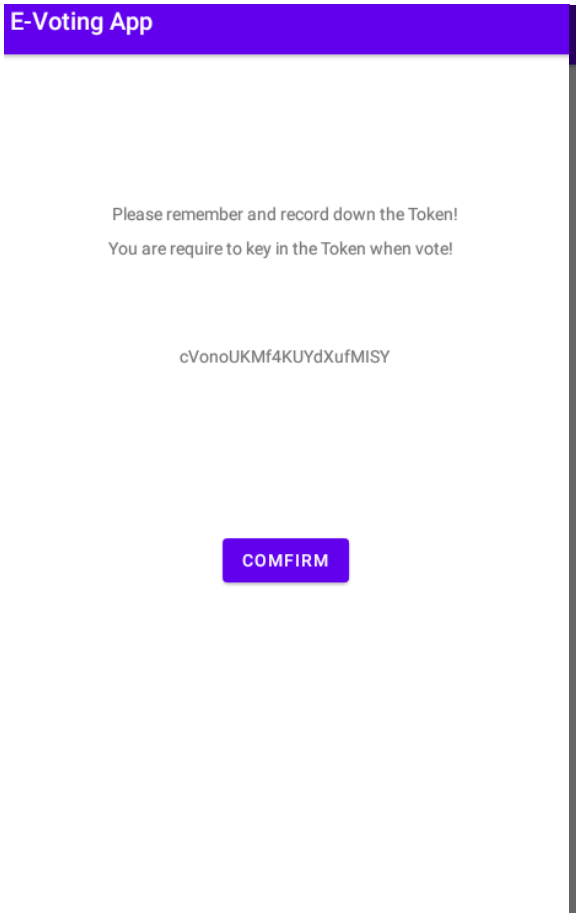


Figure 4.5: Display Token

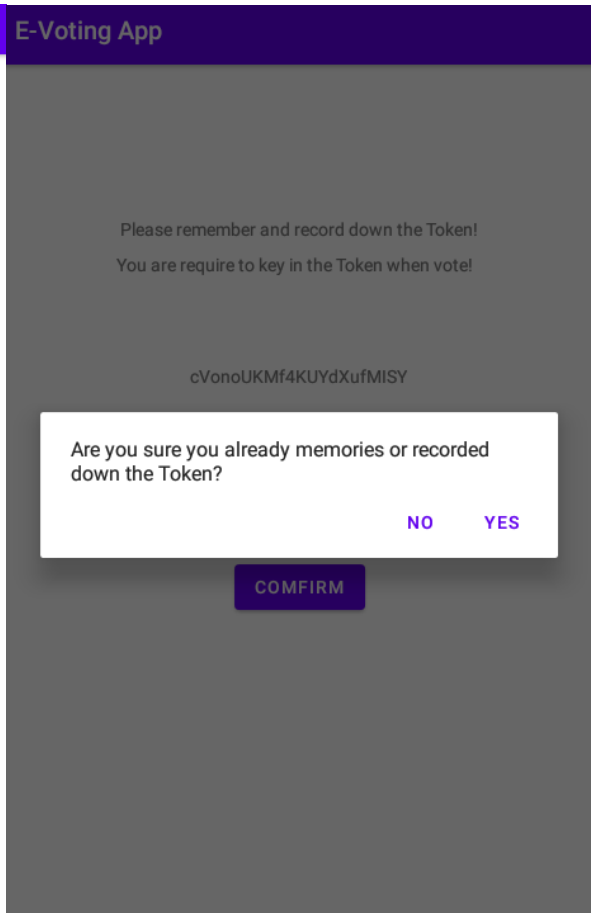


Figure 4.6: Confirmation

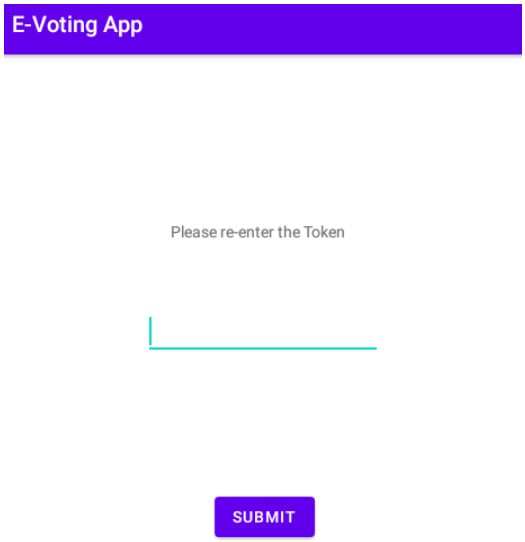


Figure 4.7: Re-Enter Token

After the user key in the correct OTP verification code. The system will generate a random string Token for user. Users need to remember the token and record down. After user click confirm, the system will ask user to re-enter the token to make sure the user is memories correctly.

4.1.2 Login

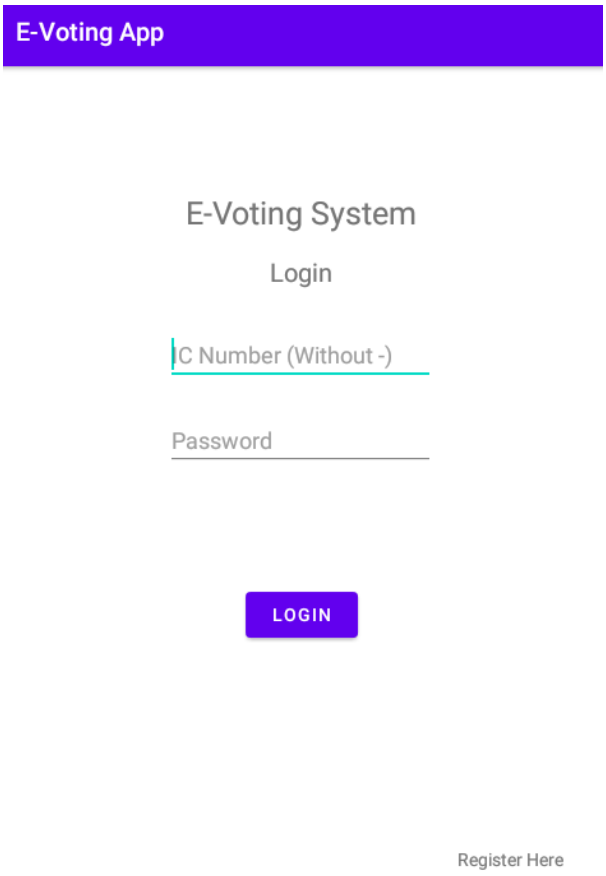


Figure 4.8: Login Page

This is login page; the user needs to enter their IC number and password to login. If the vote is haven't start and open to vote, the system will forward the user to check eligible status page. When vote is open, the system will forward to Login Token page. Besides, if the user already makes their vote before, the system will show "you already voted before"

4.1.2.1 Check Eligible Status

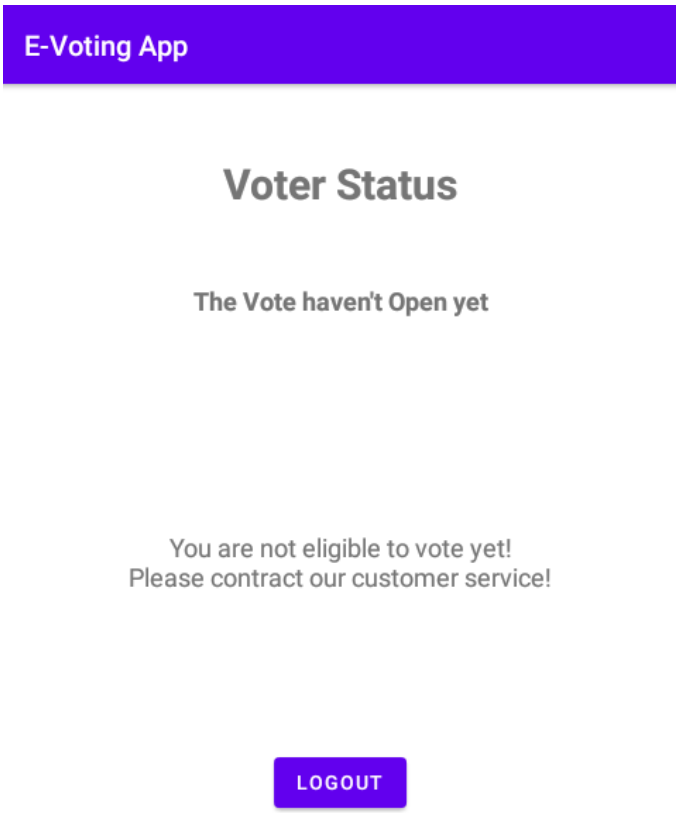


Figure 4.9: Check Eligible Status

The system will show the voter is eligible to vote or not.

4.1.2.2 Token

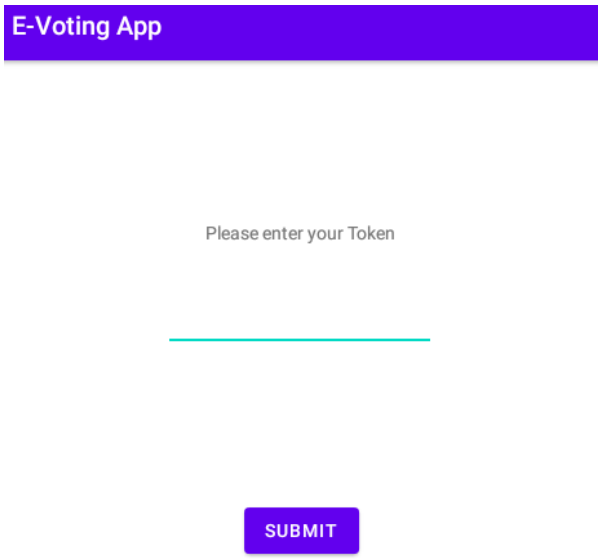


Figure 4.10: Login Token

The user needs to enter the Token that given during register. The user only can login successful and process to vote when the Token is correct.

4.1.3 Vote

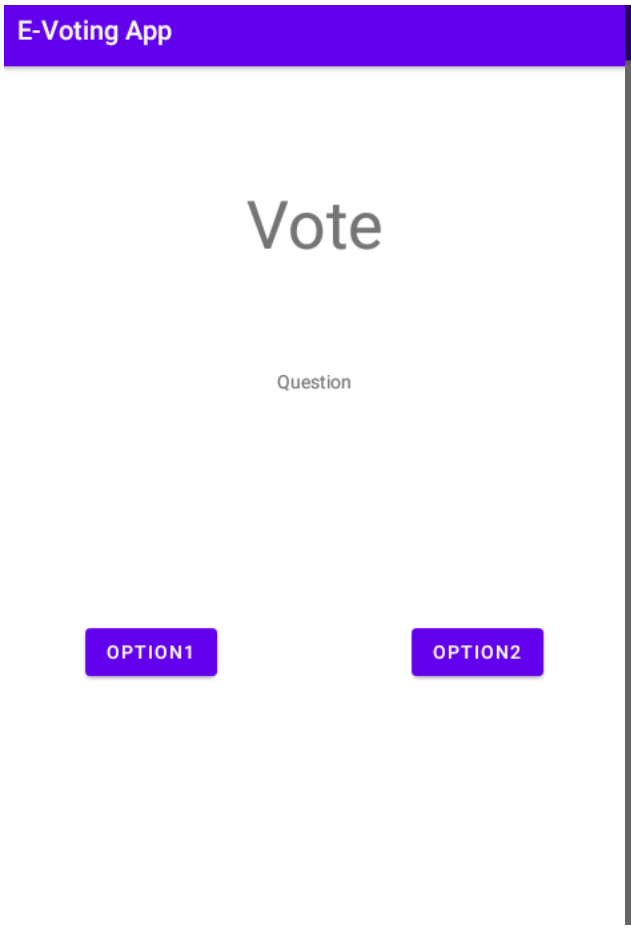


Figure 4.11: Vote Page

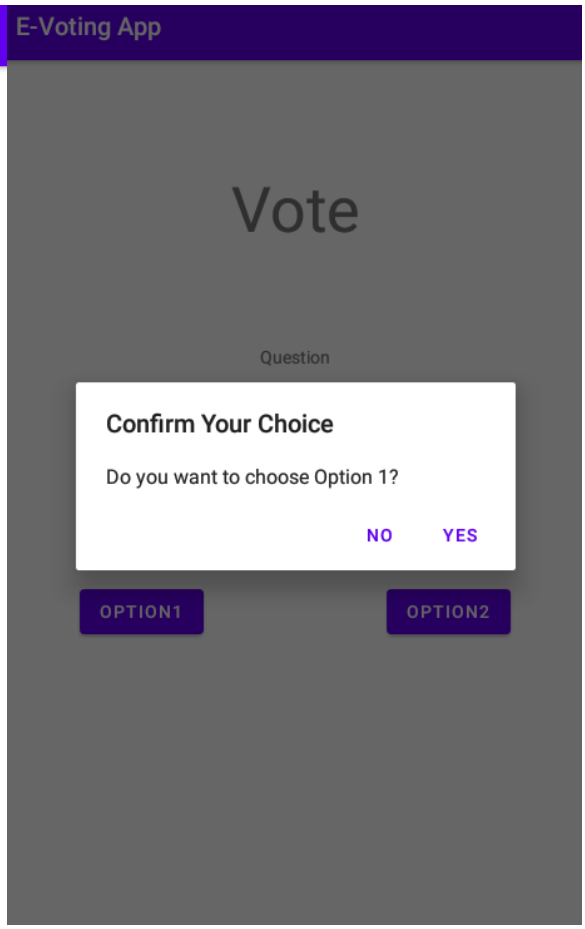


Figure 4.12: Confirmation

This is the vote page after user login successfully. In this page, the user able to see the question of vote and the option of vote. After that, user able to choose one option to vote. The system will make a confirmation with user.

4.1.3.1 Fingerprint Verification

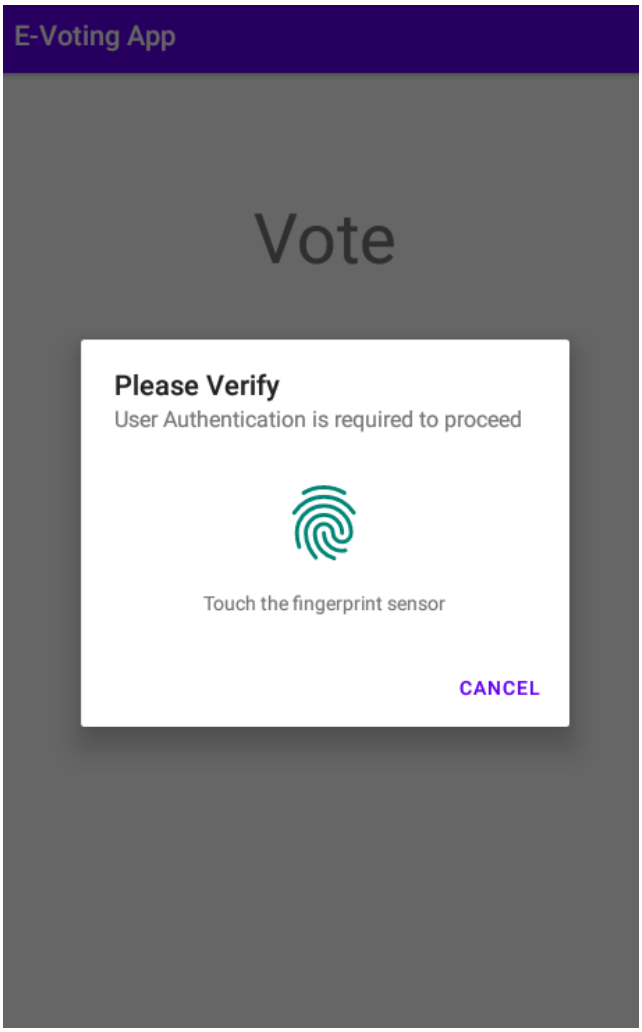


Figure 4.13: Fingerprint Verification

After user confirm want to vote the option, the system will ask for user fingerprint. After the fingerprint verification is successful, the system will record down the vote and the voting process is end. The system will back to the login screen.

4.2 Admin

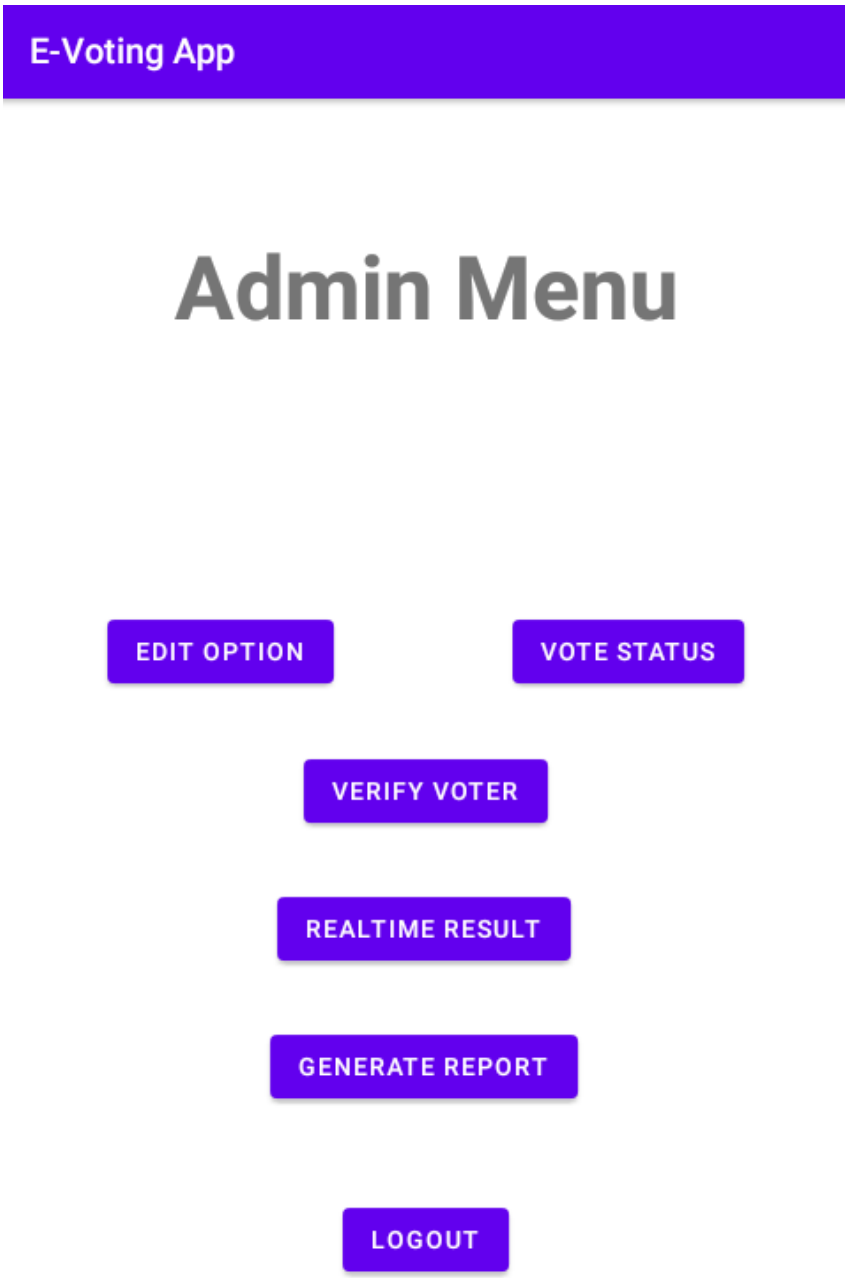


Figure 4.14: Admin Menu

The admin can make change to option, verify user identity, check real-time result and statistics report. Admin can login by enter “0000” for both IC and Password in Login Page.

4.2.1 Edit Vote Option

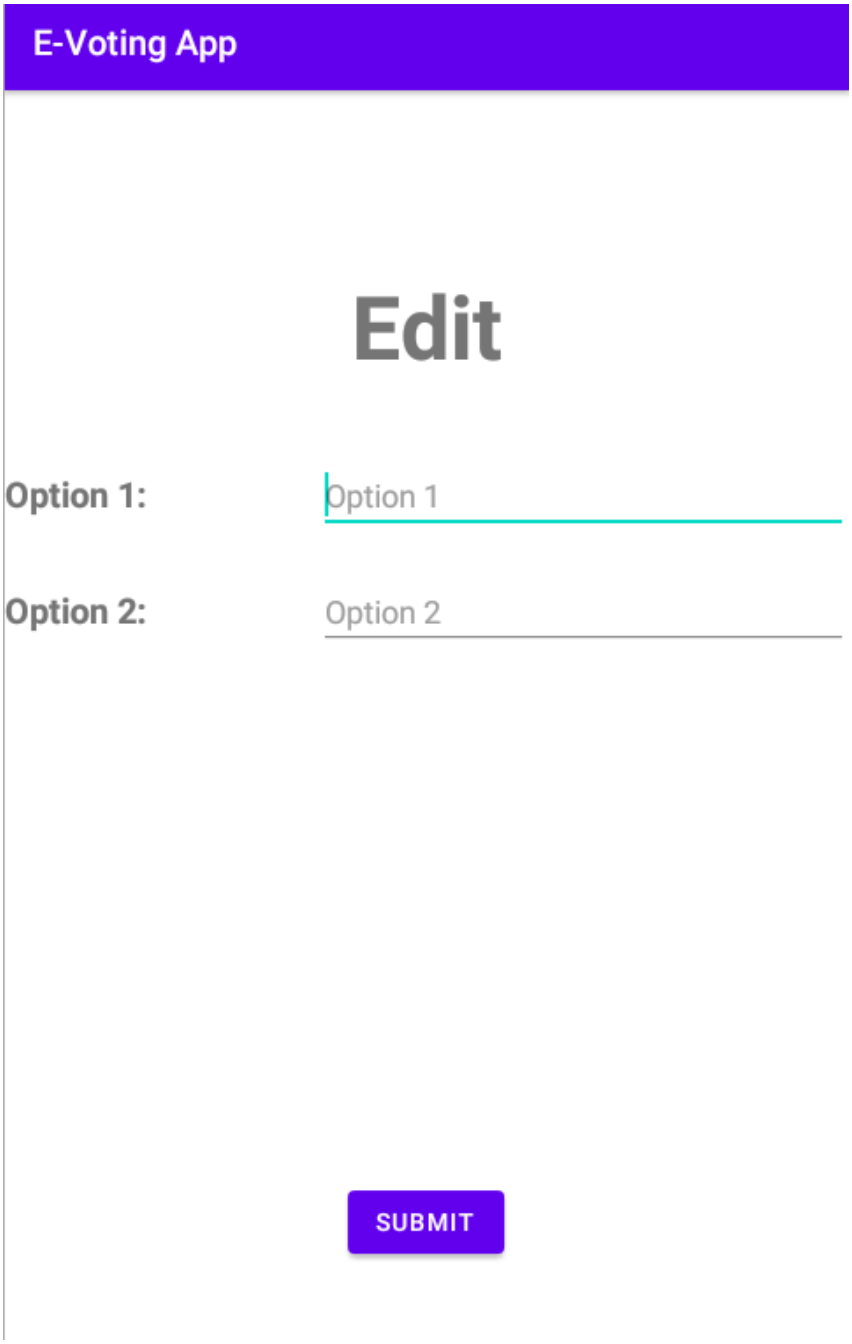


Figure 4.15: Edit Vote Option Page

The admin can enter the title or name of the option to rename them. The system will update to the database after admin submit this edit form.

4.2.2 Vote Status

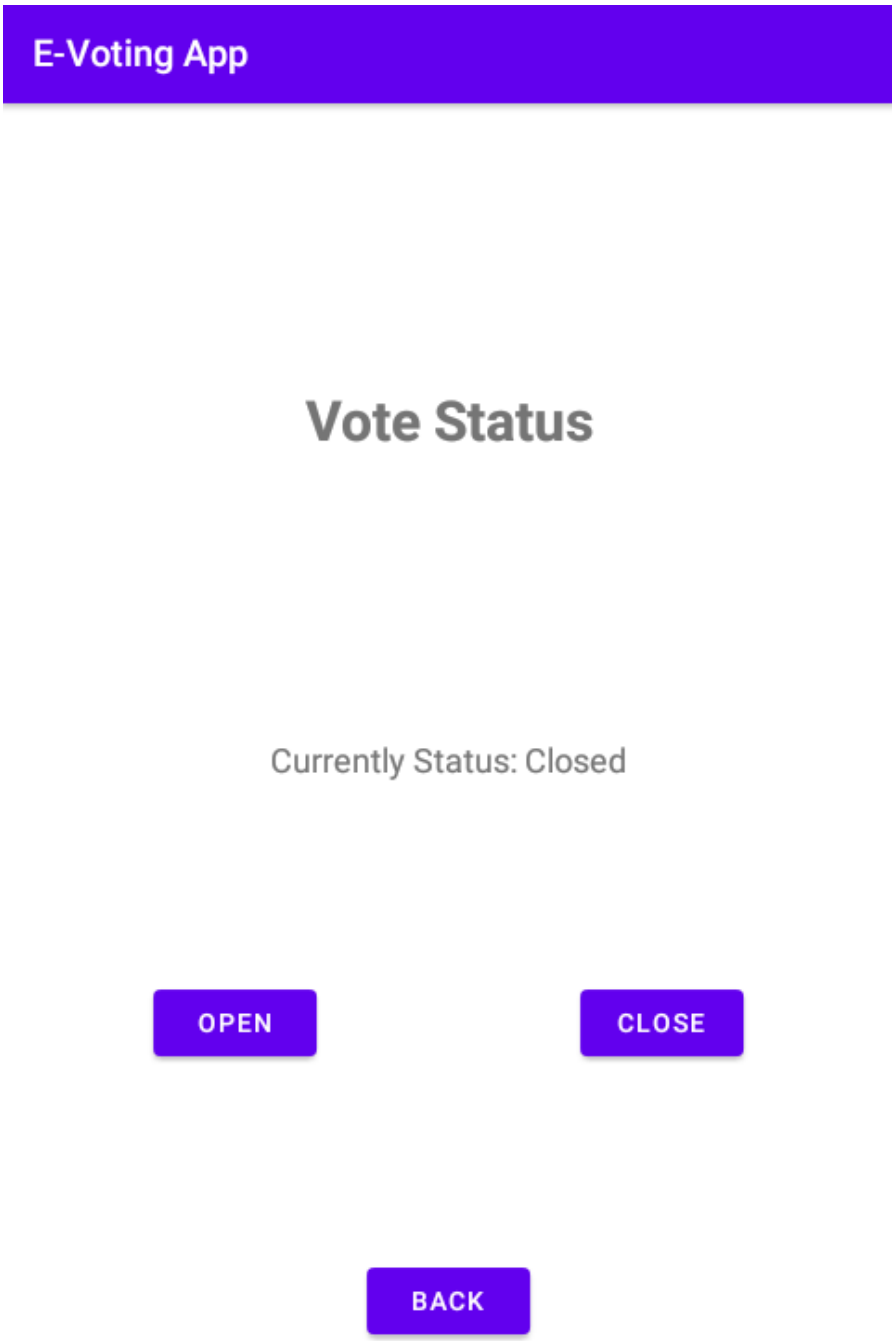


Figure 4.16: Vote Status

4.2.3 Verify Voter

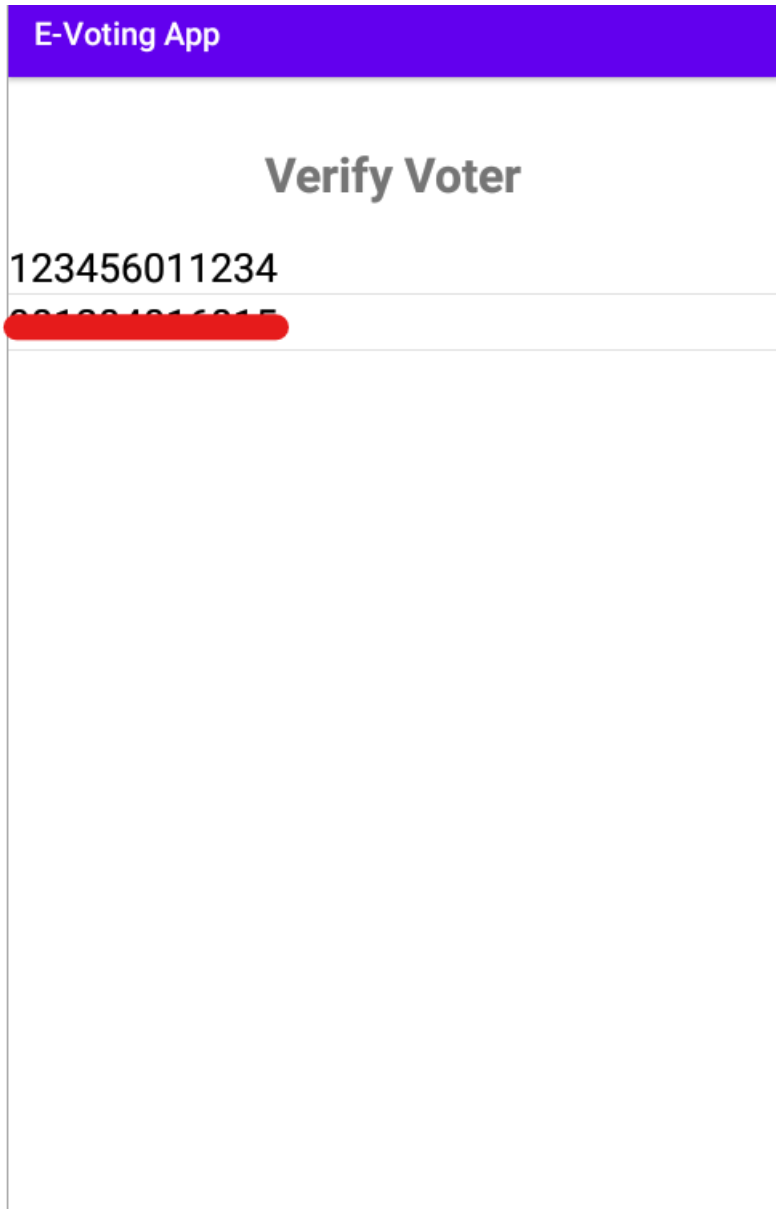


Figure 4.17: Verify Voter

When admin click the button “Verify Voter” in Admin Menu page, the application will redirect admin to this page. In this page, the admin can see a list for registered but unverified voter. The list is show and sort by IC number.

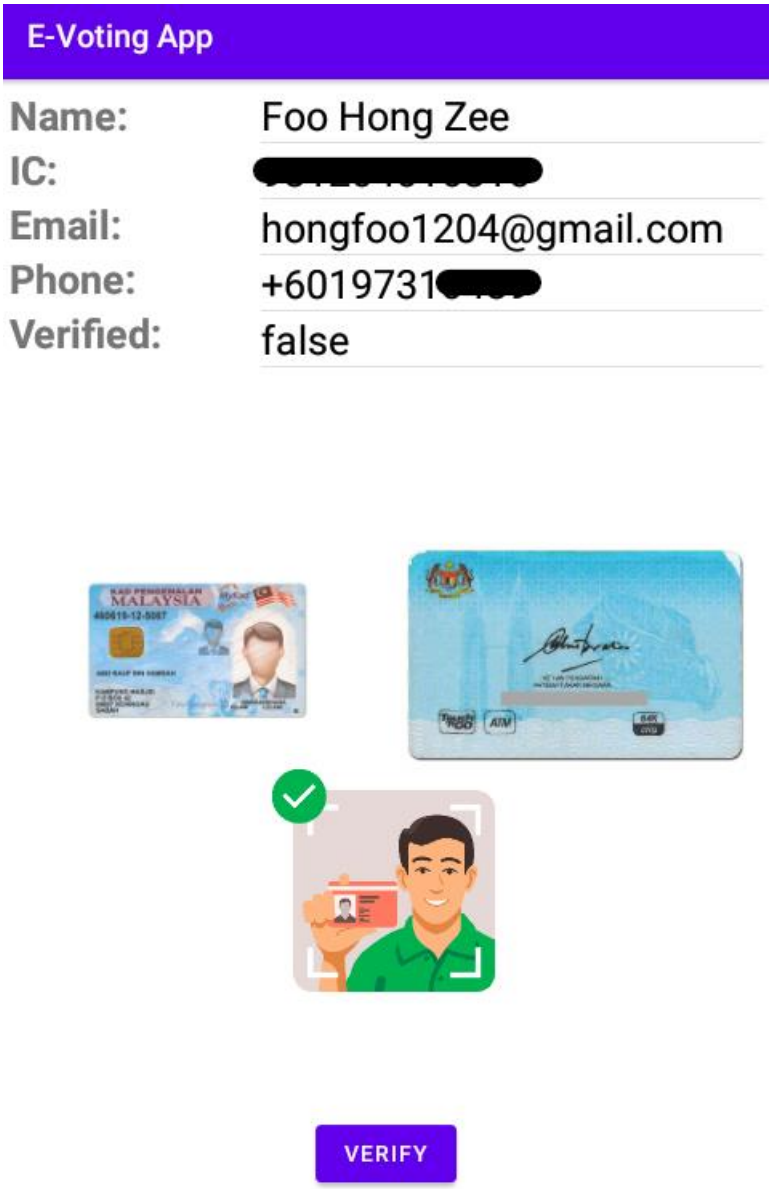


Figure 4.18: Voter Info

After admin click on the item in the list, the application will redirect to this Voter Info page. The admin can identity the voter information and decide wherever to verify this voter or not.

4.2.4 Realtime Result

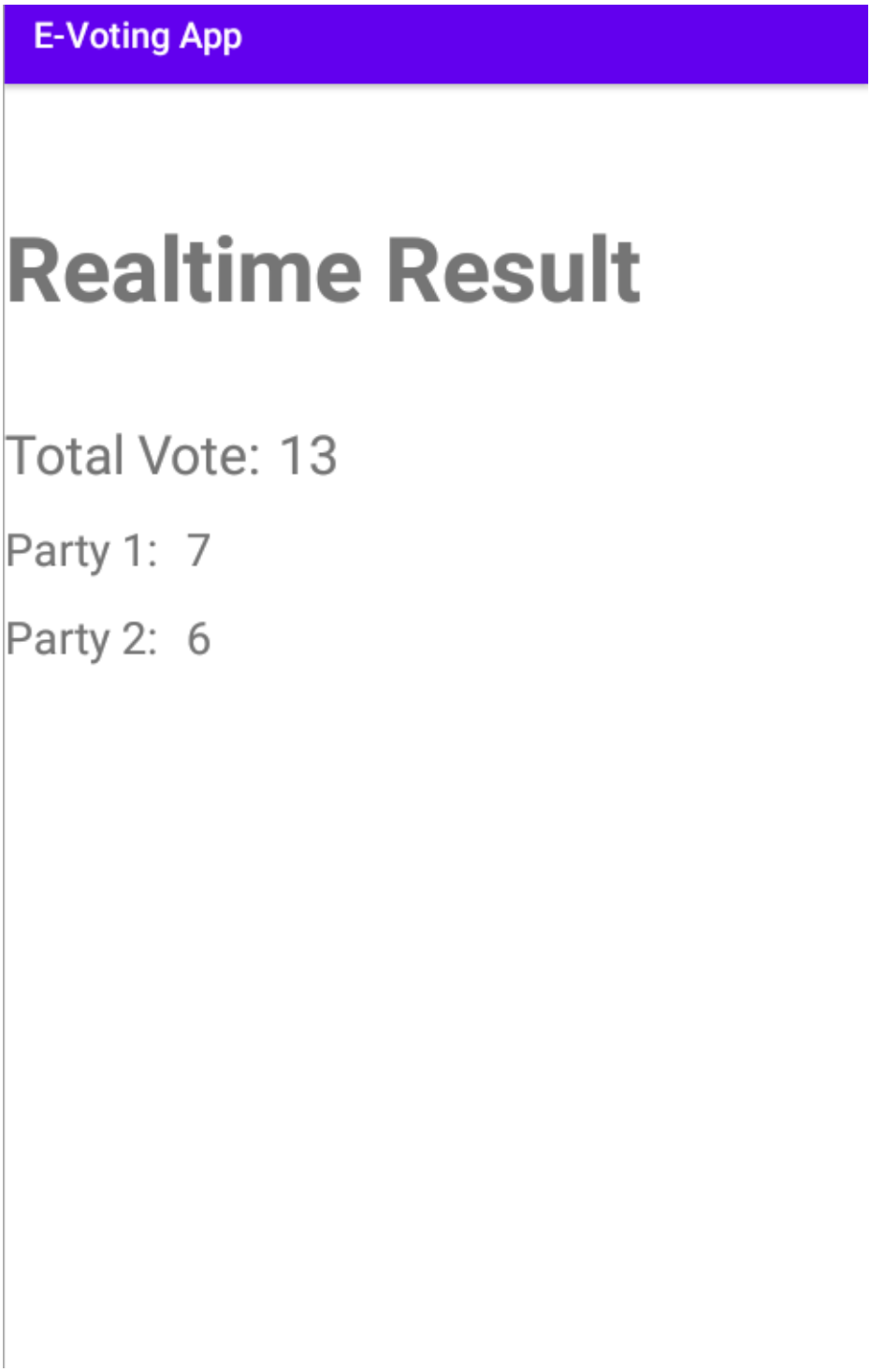


Figure 4.19: Realtime Result

After admin click on the button “Realtime Result”, the application will come to this page. This page will show the real-time result from Firebase Realtime Database. It will show the total vote amount, vote amount of option1 and option2.

4.2.5 Statistic Report

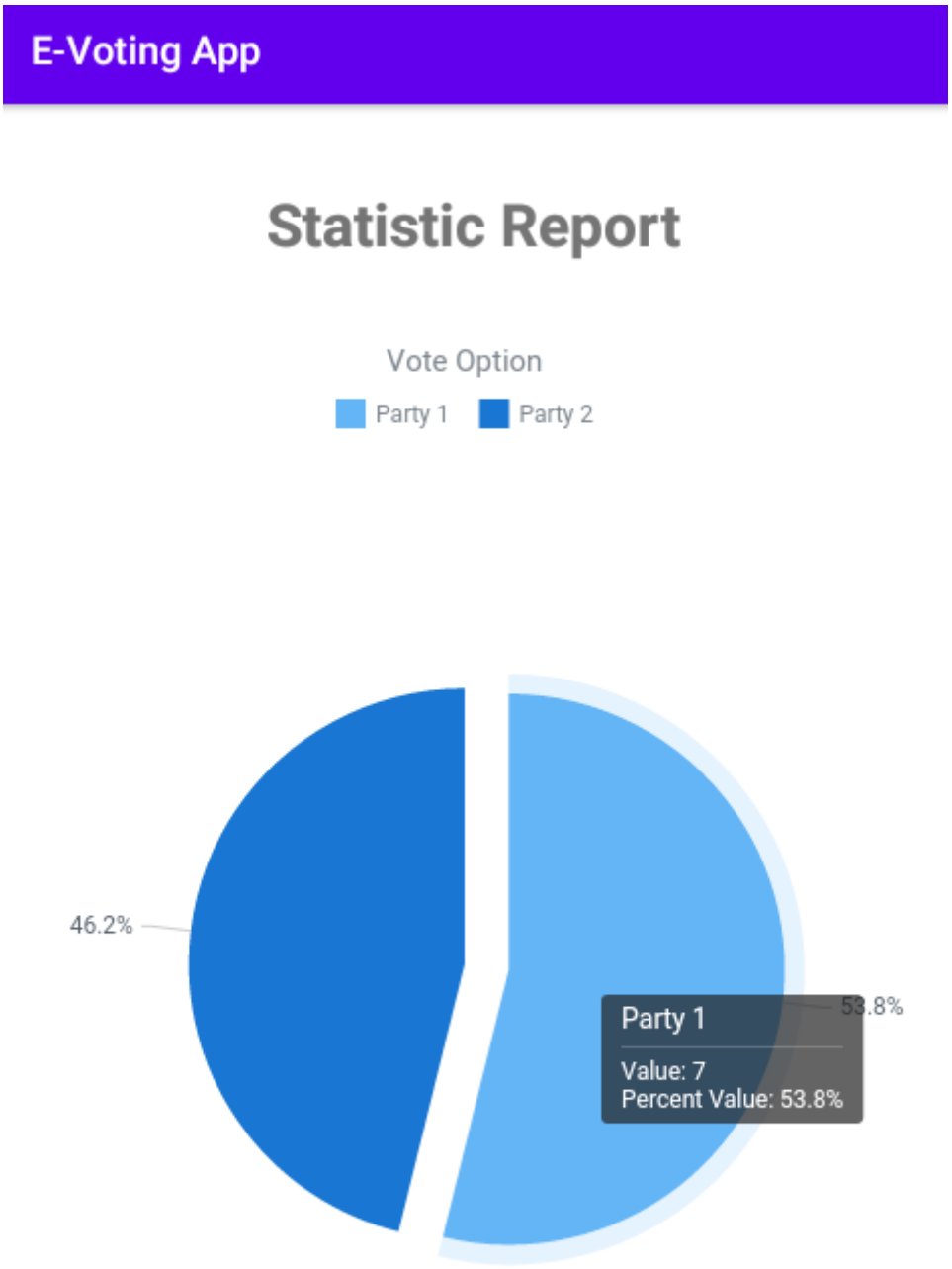


Figure 4.20: Statistic Report

This page shows the statistic of the vote result. A pie chart is showed, the amount and precent value of each option.

4.3 System Testing

4.3.1 Decision Table Test: Register

The table below is showing the action of the system will perform when user achieved the condition. The user must not have any of the conditions below to complete the Register.

Condition/Rules					
Information Form not complete	T	F	F	F	F
IC registered before	-	T	F	F	F
OTP verify failed	-	-	T	F	F
Either one image is empty	-	-	-	T	F
Re-enter Token failed	-	-	-	-	T
Actions					
Ask user to complete the form	Y	N	N	N	N
Tell user the IC is registered before	N	Y	N	N	N
Ask user to re-enter OTP	N	N	Y	N	N
Ask user to upload image for both	N	N	N	Y	N
Ask user re-enter Token	N	N	N	N	Y

Table 4.1: Register Decision Table

4.3.2 Decision Table Test: Login

The table below is showing the action of the system will perform when user achieved the condition. The user must not have any of the conditions below to complete the Login.

Condition/Rules						
Admin Login	T	F	F	F	F	F
Account not found	-	T	F	F	F	F
Password incorrect	-	-	T	F	F	F
Vote no open	-	-	-	T	F	F
User not eligible	-	-	-	-	T	F
User vote before	-	-	-	-	-	T
Actions						
Go Admin page	Y	N	N	N	N	N
Ask user to register	N	Y	N	N	N	N
Ask user to enter correct password	N	N	Y	N	N	N
Go check voter eligible status page	N	N	N	Y	N	N
Tell user not eligible to vote	N	N	N	N	Y	N
Tell user had vote before.	N	N	N	N	N	Y

Table 4.2: Login Decision Table

4.3.3 Black-Box Testing

Black-box testing is one of the techniques for software testing. Black-box testing is testing the functionality of the software without knowing the internal coding.

Functionality	**Input**	**Actual Result**	**Expect Result**
Fingerprint Verification	Fingerprint 1	Success	Success
Fingerprint Verification	Fingerprint 2	Failed	Failed
Edit Vote Option	"Party 1" for option 1	Voter vote option 1 button become "Party 1" button	Voter vote option 1 button become "Party 1" button
Edit Vote Option	"Party 2" for option 2	Voter vote option 2 button become "Party 2" button	Voter vote option 2 button become "Party 2" button
Vote Status	"OPEN" Button	Vote Open	Vote Open
Vote Status	"CLOSE" Button	Vote Close	Vote Close
Verify Voter	"VERIFY" Button	Voter Verified = true	Voter Verified = true
Realtime Result	Voter vote option 1	Total vote +1, Option 1 +1	Total vote +1, Option 1 +1
Realtime Result	Voter vote option 2	Total vote +1, Option 2 +1	Total vote +1, Option 2 +1
Statistic Report	-	Amount on pie chart is same with Realtime result, Percentage is correct	Amount on pie chart is same with Realtime result, Percentage is correct

Table 4.3: Black-Box Testing

Chapter 5

System Evaluation and Discussion

This chapter is going to evaluate and discuss about the system of this project, the security, technology use in this project will be discuss.

5.1 Security & Fraud Prevent

This project is achieved the objective 1, 2 & 3. But the objectives 4 and 5 is not completely achieved. Even there are so many authentications and fraud prevent function, there still have a chance the system might have bug or being fraud. Because there is very difficult and nearly impossible to build a prefect and fully secure system, there must be some hacker or chance to bypass the security of the system. But the voting process should be fair which should not affect by fraud, especially election for government.

Even this project is not perfectly and not totally fraud free. But it does solve a lot of problem that traditional voting system facing, such as time consuming, cost consuming, manpower consuming and also cannot totally prevent fraud or mistake. Therefore, a good e-voting system might be a solution to replace the traditional voting system. This project might not be able to perfectly replace or solve the traditional voting system. However, this project can keep improve to become more secure and less chance for fraud.

5.2 Android Mobile Application

This project is achieving the objectives. But since the application of this project is build as Android Mobile application which mean only Android mobile phone user is able to use the device. Even Android having largest market in mobile phone market, but there are still have some people are using others phone that build as other OS, such as iPhone (IOS), Huawei (HarmonyOS). The e-voting system should be providing the vote service for every user. Therefore, the project can be improving by develop the system for other OS and Website.

Chapter 6

Conclusion

In this chapter, the project review, future work will be discussing. Besides, the limitation to the currently program also will be mention. To overcome the limitation of current program, some methodology and technique might be the solution for the limitation.

6.1 Project Review and Discussion

As conclusion, the project is going well can completed with the project objective and the project plan. Since, this project is developed by AGILE development method. The application is slightly different with the early planning, the application is become better in functionality and performance.

The system is able to perform the voting process completely, even for the pre-process and post-process, such as register, login, authentication, vote, check result and generate report. The vote is real time record into the database and also the result is showing the real time result.

There are a lot of authenticate method in the system. For register, there are real information needed, OTP code send to user phone, Token provide by system. For login, the voter only can vote one time, the voter only can login after verified by admin, the voter need to enter the Token to login. For vote, the voter need to authenticate their fingerprint to vote successful.

6.2 Novelties and contributions

Since in this era, most of the people have a smartphone, a phone e-voting system application can be designed. If the e-voting system can be use by government, the election for the government can be save a lot of cost and manpower for the country. Besides, people also can have their right to be an important role as a citizen for democracy.

Moreover, a lot of company especially big company which having a lot of employees, the employee can easily know the things organization doing and vote for their choice and opinion. Admin also can get result of vote instantly to know the opinion of all employees.

But due to the COVID 19 and others sickness, this makes a lot of impact to our social life. To minimum the risk of getting sick, people need to keep a good social distance. But in traditional voting method, people need to gather and queue up to make their vote, this makes a lot of physical contacts within voters.

6.2 Limitation

Even the system has so many authentications method during the voting process, but there is not fully ensure for the security due to it is an electronic voting system. As all we know, there are no such totally bug free or totally secure system. The system might face someone to find a lot of ways to fraud the authenticates and break the security.

Besides, since the voting process is a very important process, it should be ensuring the fairness. As the discussion in chapter 2, there are a lot of limitation on traditional voting system. Moreover, this project tries to overcome the limitation of traditional voting system. But even it overcome some of the limitation, some limitations are not able to totally solve.

6.3 Future Work

Since the system in this project is not able to fully ensure the security and fraud free. But the system can keep increase the security of the system, and also improve the authentication of the system to make the system become harder and harder to break or cheat. Therefore, the chance of voting system getting fraud is become less.

REFERENCES

Aanjana Devi, S, Dr.Palanisamy, V & Anandha Jothi, R 2017, 'Confidential E-Voting System Using Face Detection and Recognition', International Journal of Engineering and Techniques, vol. 3, no. 4

Asker, M, Gerben, T.B, Sabih, H, Leo, P.J and Berend, J 2000, 'A Correlation-Based Fingerprint Verification System', Veldhoven, The Netherlands.

Blanc, J 2007, 'Challenging the Norms and Standards of Election Administration: Electronic Voting*', IFES, pg. 11-19

Bronack, T n.d., 'The problems with a paper based voting system'. Available from:

<http://www.dcag.com/images/White_Paper_-_The_problems_with_a_paper_based_voting_system.pdf>

Deeba, F, Memon, H, Dharejo, FA, Ahmed, A & Ghaffar, A 2019, 'LBPH-based enhanced real-time face recognition', International Journal of Advanced Computer Science and Applications, vol. 10, no.5

Hazzaa, F & Kadry, S 2012, 'New System of E-Voting Using Fingerprint', International Journal of Emerging Technology and Advanced Engineering, vol. 2, no. 10

Hendre, H, Parab, V, Kakade, G & Kamble, N 2016, 'Comparison of Iris Biometric Algorithms', 'International Journal of Innovative Studies in Sciences and Engineering Technology', vol. 2, no. 3

Invite User to Your App, 2020. Available from:< https://firebase.google.com/docs/dynamic-links/use-cases/user-to-user#android>

Jumb, V, Martin, J, Figer, P & Rebello, A 2015, 'Mobile Voting Using Finger Print Authentication', International Journal of Engineering and Advanced Technology (IJEAT), vol. 4, no. 4

Komatineni, S & Lingala, G n.d., 'Secured E-voting System Using Two-factor Biometric Authentication'

Lameez, O 2019, 'E-voting: Which countries use it, where has it failed and why?', News24 10 May. Available from:<https://www.news24.com/fin24/economy/e-voting-which-countries-use-it-where-has-it-failed-and-why-20190510>

Mamyrbayev, O, Mekebayev, N, Turdalyuly, M, Oshanova, N, Medeni, TI & Yessentay, A 2019, 'Voice Identification Using Classification Algorithms'

Mushtaq M A 2020, 'How To Generate QR Code In Android'. Available from:< https://www.c-sharpcorner.com/article/how-to-generate-qr-code-in-android/>

Nagpal, B, Kumar, K, Pandey, P, Vij, S & Vaishali 2015, 'Minutiae vs. Correlation: Analysis of Fingerprint Recognition Methods in Biometric Security System', 'International Journal of Engineering and Advanced Technology (IJEAT)', vol. 5, no. 1

Naser Zaeri 2011, 'Minutiae-based Fingerprint Extraction and Recognition', Available from:<https://www.intechopen.com/books/biometrics/minutiae-based-fingerprint-extraction-and-recognition>.

Parveen, A, Habib, S & Sarwar, S 2013, 'Scope And Limitation Of Electronic Voting System' International Journal of Computer Science and Mobile Computing (IJCSMC), vol. 2, no. 5, pp. 123-128

Ravi, D n.d., 'Biometrics and E-Voting'. Available from: <https://resources.infosecinstitute.com/biometrics-and-e-voting/>

Sanyasi Naidu, P, Kharat, R, Tekade, R, Mendhe, P & Magade, V n.d, 'E-Voting System Using Visual Cryptography & Secure Multi-party Computation'

Sirovich, L & Kirby, M 1987, 'Low-Dimensional Procedure for the Characterization of Human Faces', Journal of the Optical Society of America, A 4 pp. 519-524.

Step-By-Step Guide To Implementing A Fingerprint Scanner In Your Android Application, 2018. Available from:< https://jetruby.com/blog/step-by-step-guide-to-implementing-a-fingerprint-scanner-in-your-android-application/>

Triggs, R 2019, 'How fingerprint scanners work: optical, capacitive, and ultrasonic variants explained', Available from:< https://www.androidauthority.com/how-fingerprint-scanners-work-670934/>

Turk, M & Pentland, A 1991, 'Eigenfaces for Recognition', Journal of Cognitive Neuroscience, vol. 3, no. 1, pp. 71-86.

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S2	**Study week no.: 6**
Student Name & ID: Foo Hong Zee 17ACB06085	
Supervisor: Phan Koo Yuen	
Project Title: Design and Development of a Secured Electronic Fingerprint Voting System	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Fingerprint function
- Prepare report 2 (Chapter 1,2,3)
- Make change to report chapter 3 system design and diagram

2. WORK TO BE DONE

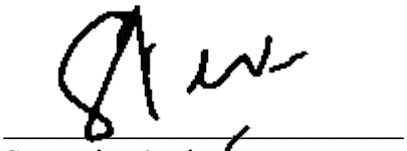
- Prepare Report (Chapter 4)
- Improve system register and login authentication (Token)

3. PROBLEMS ENCOUNTERED

No problem

4. SELF EVALUATION OF THE PROGRESS

Ok, need to put more effort.



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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S2	**Study week no.: 7**
Student Name & ID: Foo Hong Zee 17ACB06085	
Supervisor: Phan Koo Yuen	
Project Title: Design and Development of a Secured Electronic Fingerprint Voting System	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Token authentication
- Prepare report 2 (Chapter 4)

2. WORK TO BE DONE

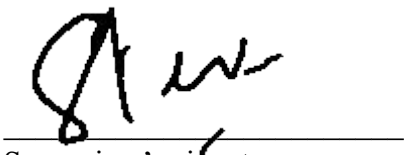
- Prepare Report (Chapter 5)
- Program – Admin part

3. PROBLEMS ENCOUNTERED

No problem

4. SELF EVALUATION OF THE PROGRESS

Ok, keep going.



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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S2	**Study week no.: 8**
Student Name & ID: Foo Hong Zee 17ACB06085	
Supervisor: Phan Koo Yuen	
Project Title: Design and Development of a Secured Electronic Fingerprint Voting System	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Prepare Report (Chapter 5)
- Program – Admin part

2. WORK TO BE DONE

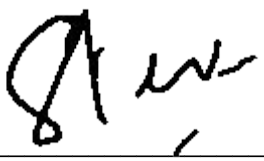
- Software Testing
- Improve User Interface
- Report (Chapter 6-conclusion)

3. PROBLEMS ENCOUNTERED

No problem

4. SELF EVALUATION OF THE PROGRESS

Ok, keep going.



Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S2	**Study week no.: 9**
Student Name & ID: Foo Hong Zee 17ACB06085	
Supervisor: Phan Koo Yuen	
Project Title: Design and Development of a Secured Electronic Fingerprint Voting System	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Prepare Report (Chapter 6 & improve overall)

2. WORK TO BE DONE

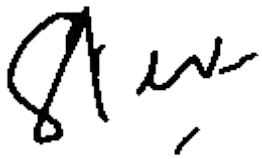
- Software Testing
- Improve User Interface

3. PROBLEMS ENCOUNTERED

No problem

4. SELF EVALUATION OF THE PROGRESS

Ok, keep going.



Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S2	**Study week no.: 10**
Student Name & ID: Foo Hong Zee 17ACB06085	
Supervisor: Phan Koo Yuen	
Project Title: Design and Development of a Secured Electronic Fingerprint Voting System	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Finalize report
- Software Testing

2. WORK TO BE DONE

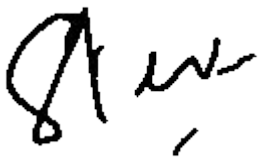
- Improve program
- Improve report

3. PROBLEMS ENCOUNTERED

No problem

4. SELF EVALUATION OF THE PROGRESS

Ok, keep going.



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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S2	**Study week no.: 11**
Student Name & ID: Foo Hong Zee 17ACB06085	
Supervisor: Phan Koo Yuen	
Project Title: Design and Development of a Secured Electronic Fingerprint Voting System	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Improve program
- Improve report

2. WORK TO BE DONE

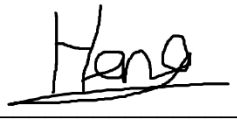
3. PROBLEMS ENCOUNTERED

No problem

4. SELF EVALUATION OF THE PROGRESS

Ok, keep going.

Supervisor's signature



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POSTER

UTAR FICT

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UNIVERSITI TUNKU ABDUL RAHMAN

Electronic Fingerprint Voting System

Overview

Voting is a way that make peoples nowadays to have the right for make decision. The decision of every participants will be collected, and the final decision will make through the result of the vote. Voting is very common in our real life from deciding the lunch with friend up to election for the leader of the country. But there is some problem and issue to the voting system, especially for the traditional voting system.

Objective

1. To provide user to vote in anytime and anyplace.
2. To provide a platform for user to create their own voting event.
3. To able user to create and share invite link and QR code.
4. To prevent fraud issues occur during voting process.
5. To prevent fake and unaccepted vote.
6. To ensure the identity of user are real and accuracy.
7. To prevent identity theft for stealing user identity.

Description & Methodology

1. Login & Register
2. Create or join the vote event
3. Choose the Selection to Vote
4. Use fingerprint to verify identity
5. Show the result after event end

android

Supervisor:

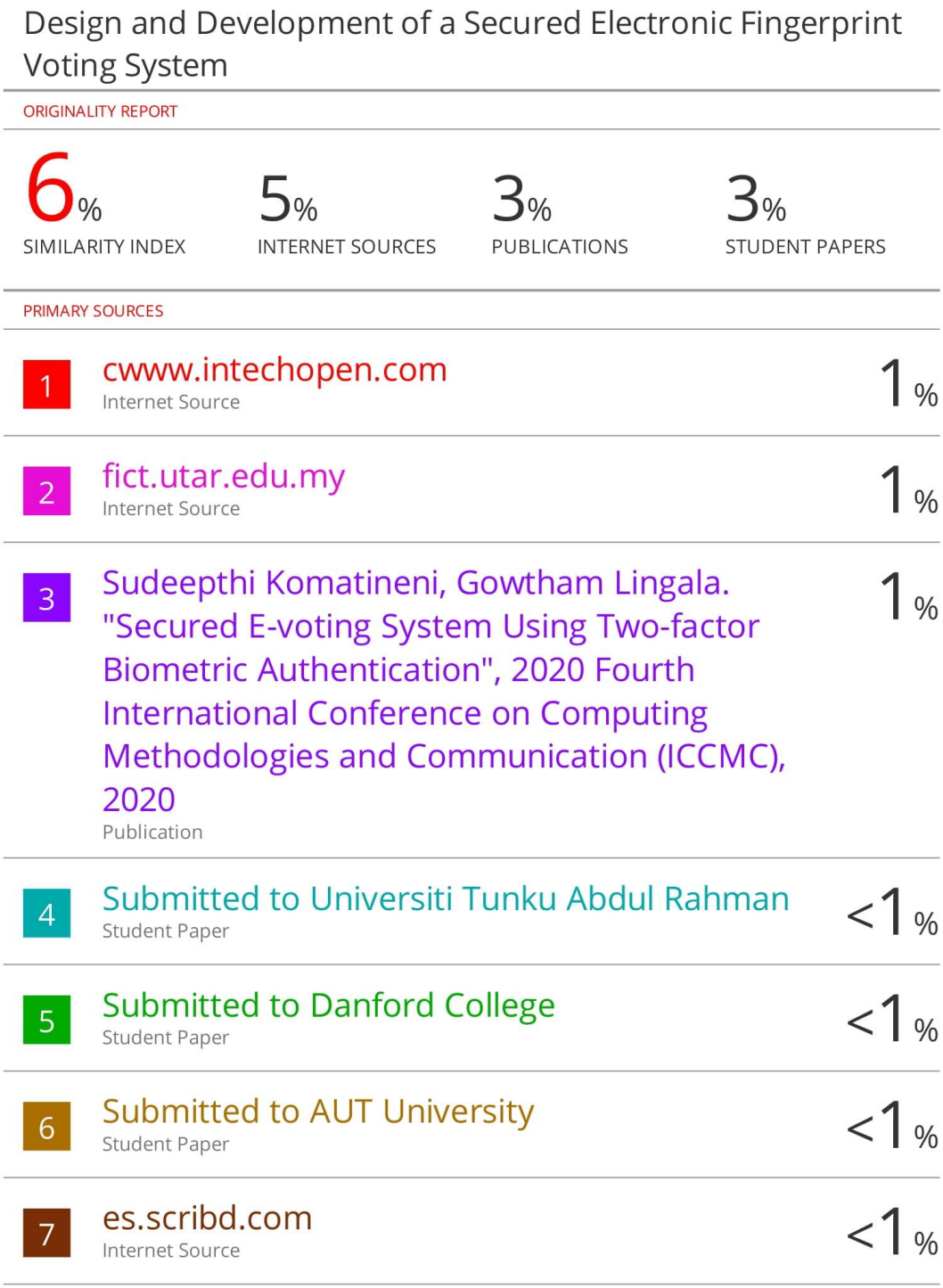
Mr. Phan Koo Yuen

Done by:

Foo Hong Zee

Bachelor of Computer Science (Honours)
Faculty of Information and Communication Technology (Kampar Campus), UTAR

PLAGIARISM CHECK RESULT



Design and Development of a Secured Electronic Fingerprint Voting System

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FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Foo Hong Zee
ID Number(s)	17ACB06085
Programme / Course	CS
Title of Final Year Project	Design and Development of a Secured Electronic Fingerprint Voting System

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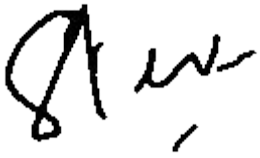

Signature of Supervisor

Name: Phan Koo Yuen

Date: 1/9/2021

Signature of Co-Supervisor

Name: _____

Date: _____

UNIVERSITI TUNKU ABDUL RAHMAN

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Student Id	17ACB06085
Student Name	Foo Hong Zee
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