

An E-Voting Application Using Cryptography Technology

BY

Chin Hsin Tien

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF COMPUTER SCIENCE (HONS)

Faculty of Information and Communication Technology
(Perak Campus)

June 2020

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Date: 29/8/2020

Date: 2/9/2020

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DECLARATION OF ORIGINALITY

I declare that this report entitled “**An E-Voting Application using Cryptography Technology**” is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

Signature :  _____

Name : Chin Hsin Tien

Date : 29/8/2020

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I would like to express my sincere thanks and appreciation to my supervisors, Ts Dr Cheng Wai Khuen who has given me this bright opportunity to engage in an E-Voting Application project. It is my first step to establish a career in web application management. A million thanks to you.

In addition, I would also like to thank all the mentors who have taught me. They let me learn a lot of knowledge and the knowledge is very practical, so that my project can be completed more smoothly. Finally, I must say thanks to my parents and my family for their love, support and continuous encouragement throughout the course.

ABSTRACT

The project is mainly a web application for the purpose of online voting. This online voting system is mainly to provide an online platform for voters and candidates to vote through the Internet or sign up to participate in voting projects. In addition, the voting network system also allows managers to establish a poll for voting through the network. The main challenge to accomplish this goal is the security and confidentiality of the online voting system. This project will be completed by ASP.NET in Visual studio. In order to improve the security and confidentiality of the system, this system will also use the hashing function to complete. Hashing function mainly encrypts the user's confidential information to prevent theft by other users and the encrypt method can be implement from Visual Studio which is SHA-256 (Secure Hash Algorithm- 256 bits), a cryptographic hash function designed by US NSA (United States National Security Agency). This encryption method is one-way encryption, meaning that it cannot be revealed in the reverse direction, so no one can know what the encrypted data is except for the input user, and even the administrator cannot know what the encrypted data is. This will ensure that users can achieve the effect of anonymous voting during the voting process, and only the system itself can know. In addition, the system also uses some auxiliary functions to ensure that the user's input can be authenticated. There are several types used in this system. One is OTP, also known as One-time password, also known as dynamicpassword or one-time valid password. It is mainly used to send OTP to users by email, so that users can input the provided OTP to continue for further operation of the system, and this OTP is only one-time, the validity period is only one login session or transaction. The second is the relatively simple captcha (Completely Automated Public Turing test to tell Computers and Humans Apart). This process that requires users to enter a pre-determined code to authenticate users is not a robot. Besides that, ASP.NET itself provides multiple validation methods to validate user input and effectively improve the security and confidentiality of the system. Last but not least is the secure connection of the system. HTTPS is used instead of HTTP to achieve this effect. The biggest difference between HTTPS and HTTP is security. HTTPS communication protocol is encrypted using Transport Layer Security (TLS) or its predecessor, Secure Sockets Layer (SSL). In this system, SSLcertificate was applied to create an encrypted connection and establish trust to the web application. The main motivation of HTTPS is to authenticate the visited websites and protect the privacy and integrity of the data exchanged during transmission, so it provides a great help to the online voting system, greatly improving the security of the system to prevent hackers from invading.

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Chapter 1: Introduction

1.1 Problem Statement and Motivation

Although the E-Voting System has many advantages, there are some risk to the system. First and foremost, the most worrying is the security of the system. A simple and ordinary E-Voting System will have a lot of security issues, such as some of their personal data will be stolen by the hackers from this system through the network. In addition, the general voting system will have admin management, and they have very large powers including modifying the content of the system, so we can't ensure the fairness of the voting, which is the deadliest problems of e-voting so a method is needed to let users can also review the voting process but keep the votes secret. Besides that, as an E-Voting System, another biggest fatality is the hackers can steal someone else's account to vote, resulting in a ghost vote or account owner unable to vote effectively. Furthermore, another problem is the dependence of modern people on technology, which has led to the fact that many things around us have been technologically advanced, including voting system. Because of this, young people are very apathetic to traditional paper voting system. These are some common and important issues that I want to solve in this project. In addition, the system also has to consider the user interface, which can lead the user distaste if it is too complex and is harder for older voter to accept and use. Therefore, this project needs a technology to solve these problems, so that the system knows that we are the owner of the eligible voter account and have a one-off vote without letting others to steal our personal information. In addition, some of the existing e-voting don't have anonymous functions. That is also a challenge for the system to distinguish users under high security in the case of anonymity. Cryptography is a technology that I want to apply to this project to solve these problems by allowing authenticate the visited websites and protect the privacy and integrity of the data exchanged during transmission.

One of the motivations for this project is the practicality of the project. Because of the development of modern science and technology, our communication technology is also very developed and accompanied us for a long time, so many things will change with the time. Therefore, the voting system will be networking is also an important and must-go process. Besides that, E-voting System also can change the young peoples' attitude towards government and make it easier for people to participate in the country's election campaign. Of course, the election is just one from the examples, we are filled in with many moments in our lives that require voting decisions, so this can also approve people's perception of voting. The second of the motivation for this project is by solving the problem in existing E-Voting

System can effectively increase the trust from the user and the value of the system. This is also because the E-Voting system as a network program, the security of the system is extremely important to protect the beneficial of the user. If E-Voting system's security can be improved and practicality with some technology, it will have more benefits for people.

1.2 Project Scope and Project Objective

The objectives for this project are to provide a high security, user friendly, convenient, fairness and anonymous e-voting system for the people. In order to ensure the high security for the system, some techniques are required and also the encryption method to this project. Besides that, the user interface and the voting process must be simple to let user interact but the authenticate functions are still required, therefore it will be easier for user to accept and secure. Furthermore, the admin power will also be limited and only the owner of this application can directly make any changes to the database. Besides that, some algorithm or method were implemented to make sure the fairness of voting such as cryptography hash function SHA-256, OTP (One Time Password), Captcha (Completely Automated Public Turing test to tell Computers and Humans Apart) and so on.

Some features for this system are show below:

User:

1. Admin
2. Candidate
3. Voter

Table 1.2.1

Admin	Candidate	Voter
<ol style="list-style-type: none">1. Log in/ Log out2. Validate the candidate registration3. Validate the voter registration4. Create an election5. Create a new admin	<ol style="list-style-type: none">1. Register as candidate2. View the voting progress and result	<ol style="list-style-type: none">1. Register as voter2. Search Poll by entering the poll name3. Vote4. View the voting progress and result5. Check vote by entering own OTP

The voting system have to connect to the database for the validation of users' registration, voters' registration and further operation that needs database connection. Besides that, when users submit the registration form, the sensitive data it will be encrypted and validate with the database to make sure the users are legitimate and fulfil the requirement needs. But the candidates' registrations and voters' registration still have to validate by the admin by using

live video to capture their Identity Card and face photo to verified. After that, when voters are registered successfully, an OTP is required for user to vote and the OTP will send through the email that keyed in by voter when they register. After that, the OTP will be stored separately to database for user to identify when they view the vote result by using OTP they entered. This not only prevents voters 'information from being stolen by others, but also determines the identity of voters to avoid voting again, and also allows voters to see that their vote is already in the poll and counted. In addition to sending OTP to users via email, the system will also automatically send emails to users when they successfully or fail to register as voters or candidates, and also send emails when they successfully vote.

1.3 Impact, Significance and Contribution

Although, there are many existing systems that are very simple, convenient, and user-friendly. However, with the continuous improvement of technology, this simple or relatively old system can no longer guarantee the safety and confidentiality of users. Therefore, we also cannot guarantee the fairness and practicability of online voting. Therefore, limited administrative power or power, encryption methods, user authentication, and some tips and methods to make the system more secure must be met to improve the security and confidentiality of the system.

As we all know, the importance of electronic voting system lies in the security and fairness of the system. If both can be enhanced, more people can use it comfortably and without worry. Therefore, the electronic voting system will be widely used to reduce manpower consumption, save time, high security and fair voting. In addition, compared with the paper voting system in any case, the electronic voting system is more easily accepted by modern people.

1.4 Background Information

In an age when technology has become so advanced, many things in our lives have been technologically and electronically. As we know, voting is method for a group to make a collective opinion or decision after a discussion, campaign or debate. And voting has already existed with electronically and known as Electronic Voting (E-Voting). Besides that, E-Voting have 2 main types can be identified. We can use government election as a sample, a normal e-voting is very similar to ordinary elections with paper voting which is physically supervised by representatives of government or independent electronical authorities but using the electronic voting machines that located at polling station instead of using paper voting. Another type of e-voting is a remote e-voting via the internet which called I-voting. I-voting allow the voters to submit their vote electronically to the government representative or the election authorities from any location. In this case, I believe that most young people do not know everything in the Government, even the councillor for their own districts. Besides that, according to China Qiao Wang (2018), we found that young Malaysians are very apathetic to politics, and most of them believe that their support and opinions do not affect the Government. From BBC News, Mayuri Mei Lin (2018) pointed out that there are 18.7 million eligible voters in Malaysia in 2018, but there had 3.8 million eligible voters were unregistered and 67% of those who are unregistered are aged from 21 to 30. Furthermore, many youth people's their political knowledge and experience is limited to social media: which they are both obsessed and distrustful of social media. From the above, we knew that since modern society is dominated by network media and young people are very dependent on these media, the government also intends to use this modern technology to improve the attitude of young people towards the government. The first step in that approach is to modernize the voting system, known as E-Voting System, so that more young people can simply participate in the country's election campaign. That's because most young people have become a "slavery" on smartphones and the internet and their smartphone have not left them. Therefore, we believe that networking the voting system not only can effectively improve the young people's attitude toward the country's election campaign but also in others situation can also make the voting process easier and easier for young people to accept. In addition, the E-Voting System can also effectively reduce the human resources, but also use of technology to vote and calculate the vote, it can save a lot of time for the entire voting process compared with the traditional actual voting system. For this project, the electronic voting system is using cryptography technology, which is the encryption method SHA-256

and HTTPS protocol. SHA-256 is a hash function used to encrypt sensitive data, so others cannot read your input. Information and HTTPS is a protocol that encrypts data transmission on the network to ensure a secure connection between the networks. At last, I hope that this project can solve the problem in existing e-voting system and provide a reference for the peoples, company or country by producing an efficient and safety E-Voting System.

1.5 Highlight of what have been achieved

- 1) **Admin Login:** All information must be filled in, and the correct Re-Captcha must be filled in to log in.

Username: edwin

Password: Chin0611

Home	About Us	Contact Us	Admin Login
------	----------	------------	-------------

Admin Login

Username

Password

Captcha

Retype-Captcha


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Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
------	--------------------	---------------	----------------	--------------------

[Logout](#)

Welcome , edwin

Admin Homepage



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Figure 1.5.1 Admin Login

- 2) **Poll Creation:** After admin login, admin is allowed to create a new poll. All information must be filled in. The start date of the vote must be valid and cannot be in the past. The end date must be valid and cannot be earlier than start date.

HomeAdmin RegistrationPoll CreationVoter ApprovalCandidate Approval

Poll Creation

Poll Name

FYP leader

Description

Please Vote me

Start Date

08/04/2020

Start Time

04

00

End Date

08/19/2020

End Time

08

00

Create

Reset

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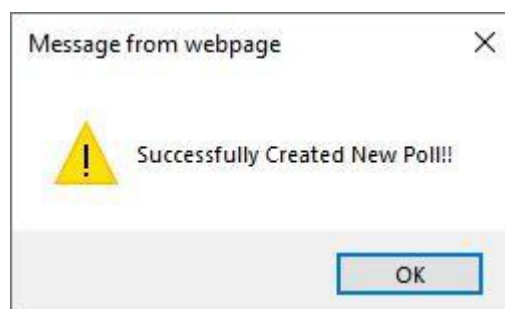


Figure 1.5.2 Poll Creation

- 3) **Create new Admin:** After admin logged in, admin is allowed to create a new admin. All information must be filled in. The retyped password must be same with the entered password. The username, email and IC cannot be reused for register new admin account.

The screenshot shows the 'Admin Registration' form within a web application. At the top, there is a navigation bar with five tabs: 'Home', 'Admin Registration' (which is highlighted), 'Poll Creation', 'Voter Approval', and 'Candidate Approval'. Below the navigation bar, the form is titled 'Admin Registration'. It contains several input fields: 'Username' with the value 'edwin2', 'Password' and 'Retype-Password' both masked with dots, 'Name' with the value 'ChinHsinTien', 'IC Number (12 digit)' with the value '992299019291', and 'Email' with the value 'edwinchin@yahoo.com'. At the bottom of the form are two buttons: 'Register' and 'Reset'. Below the form, there is a yellow footer bar with the text: 'All Content Copyright © of E-Voting System Sdn Bhd (3609-M) 2020. All Right Reserved'.

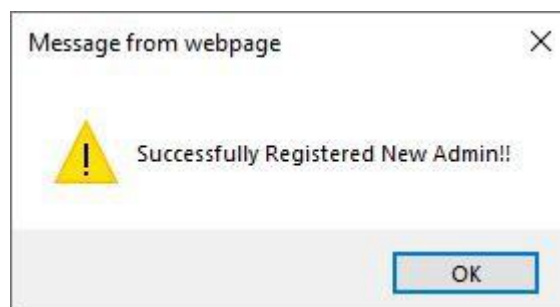


Figure 1.5.3 Create new Admin

- 4) **Register as Candidate:** Users are allowed to register as candidate before the poll start. All required information must be entered for registration. Using live camerato capture user IC and face photo.

Home	About Us	Contact Us	Admin Login
------	----------	------------	-------------

Candidate Registration (Part 1)

Please Capture Your IC and Key in your valid Email Here!

Poll Name: FYP leader

Live Image From WebCam

Captured Image

Email:

Capture Image

Next Step

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Home	About Us	Contact Us	Admin Login
------	----------	------------	-------------

Candidate Registration (Part 2)

Please take a face photo for authentication!

Poll Name: FYP leader

Live Image From WebCam

Captured Image

When you successfully register, this photo will be posted during the poll!!!

Description:

Capture Image

Submit

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Figure 1.5.4 Register as Candidate



- 5) **Register as Voter:** Users are allowed to register as voter before the poll start. All required information must be entered for registration. Using live camera to capture user IC and face photo.

Home	About Us	Contact Us	Admin Login
------	----------	------------	-------------

Voter Registration (Part 1)

Please Capture Your IC and Key in your valid Email Here!

Poll Name: FYP leader

Live Image From WebCam	Captured Image
	

Email:



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Home	About Us	Contact Us	Admin Login
------	----------	------------	-------------

Voter Registration (Part 2)

Please take a face photo for authentication!

Poll Name: FYP leader

Live Image From WebCam	Captured Image
	

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Figure 1.5.5 Register as Voter

- 6) **Voter Approval:** After admin logged in, admin is allowed to validate the voter registration and send email to the registration's owner whether rejected or approved. The administrator entered the inspection ID and IC number to authenticate the user. If the user's IC is duplicated, the registration will be rejected, otherwise it will be approved. Admin can key in 000000000000 in IC textbox to reject the registration without checking the database.

Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
------	--------------------	---------------	----------------	--------------------

Voter Approval

r_id	p_id	email	IC	real_time_record	role
43	8	edwinchin_96@yahoo.com			voter

r_id:

IC:

(#The administrator can type "000000000000" in the IC text box to reject the application without checking the database.)

r_id:43 Qualified

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Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
------	--------------------	---------------	----------------	--------------------

Voter Approval

No application

r_id:

IC:

(#The administrator can type "000000000000" in the IC text box to reject the application without checking the database.)

Email sent

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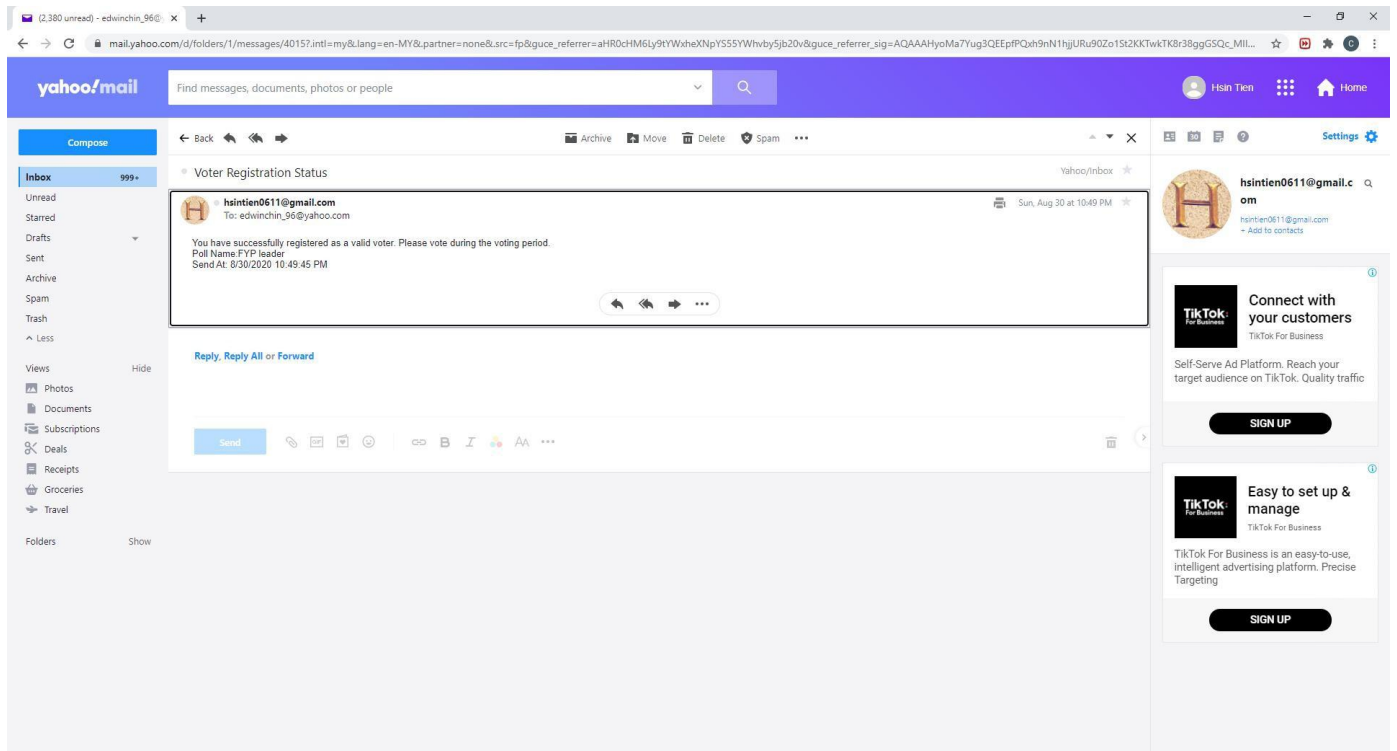




Figure 1.5.6 Voter Approval

- 7) **Candidate Approval:** After admin logged in, admin is allowed to validate the candidate registration and send email to the registration's owner whether rejected or approved. The administrator entered the inspection ID and IC number to authenticate the user. If the user's IC is duplicated, the registration will be rejected, otherwise it will be approved. Admin can key in 000000000000 in IC textbox to reject the registration without checking the database.

Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
------	--------------------	---------------	----------------	--------------------

Candidate Approval

r_id	p_id	email	IC	real_time_record	role	De
44	8	edwinchin_96@yahoo.com			candidate	My Ed

r_id:

Name:

IC:

(#The administrator can type "000000000000" in the IC text box to reject the application without checking the database.)

r_id:44 Qualified

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Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
------	--------------------	---------------	----------------	--------------------

Candidate Approval

No application

r_id:

Name:

IC:

(#The administrator can type "000000000000" in the IC text box to reject the application without checking the database.)

Email sent

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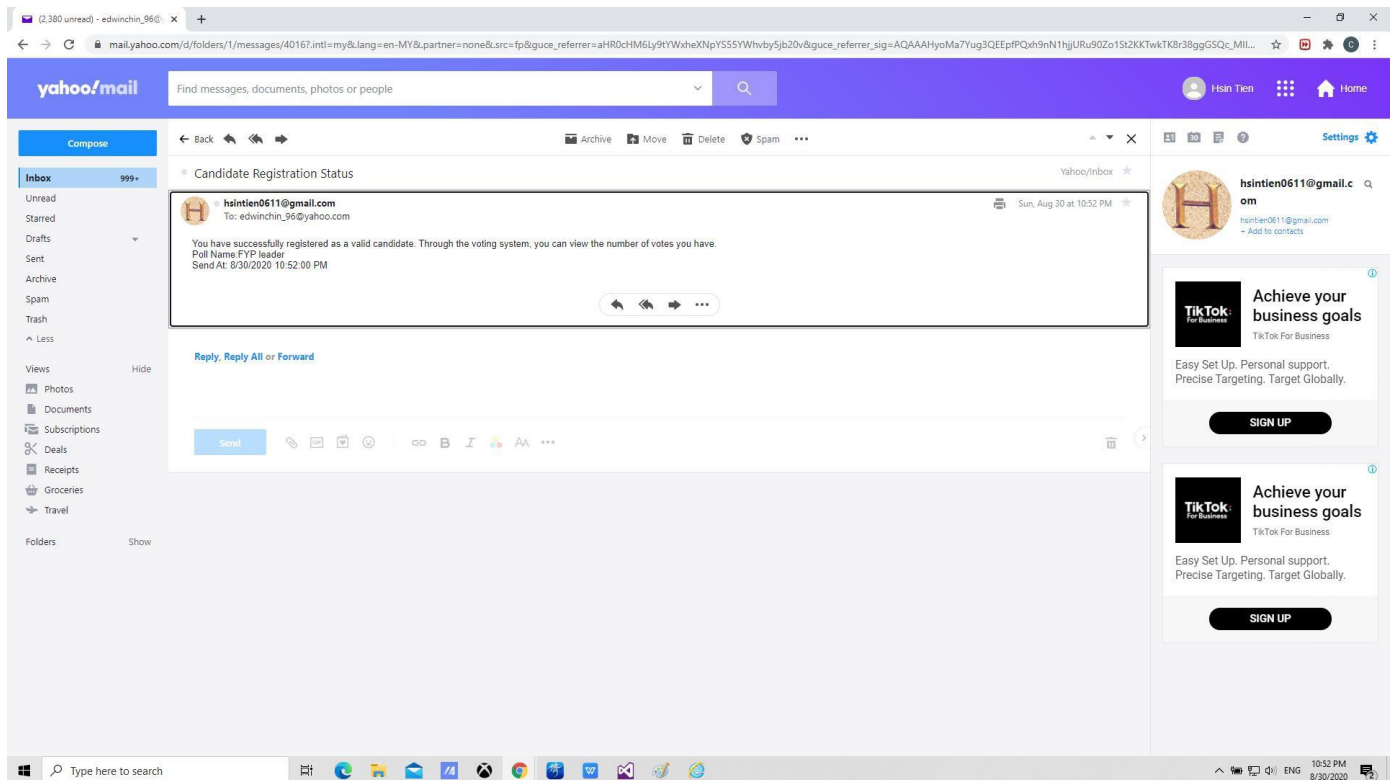


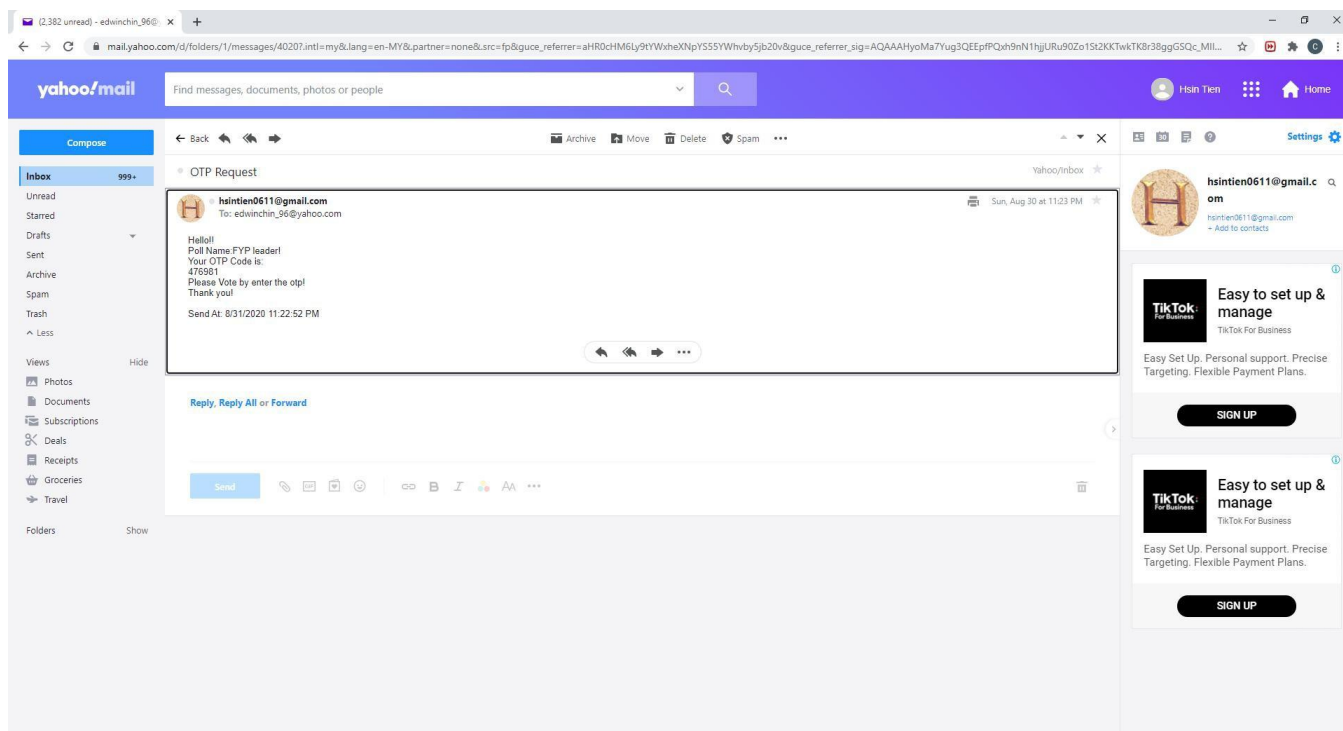


Figure 1.5.7 Candidate Approval

- 8) **Vote:** Voter is allowed to vote after they registered as a valid voter. They need to obtain an OTP for voting by entered their IC. A voter can only vote once.

Home	About Us	Contact Us	Admin Login
<p>Poll Name: FYP leader Poll Description: Please Vote me Start At: 8/31/2020 4:00:00 AM End At: 9/8/2020 8:00:00 AM</p>			
<div><p>Candidate: Chin Hsin Tien Description: Im boss</p><p><input type="button" value="Vote"/></p></div> <div><p>Candidate: Handsome Chin Description: My name is Edwin Chin</p><p><input type="button" value="Vote"/></p></div> <div><p>Candidate: Chin Hsin Tien Description: vote me</p><p><input type="button" value="Vote"/></p></div>			
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Home	About Us	Contact Us	Admin Login
<p>Poll Name: FYP leader Vote to: Chin Hsin Tien</p> <p>IC : <input type="text" value="556655665566"/></p> <p><input type="button" value="Get OTP"/></p> <p>Email sent</p> <p>OTP: <input type="text"/></p> <p><input type="button" value="Vote"/> <input type="button" value="Reset"/></p>			
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Home	About Us	Contact Us	Admin Login
<p>Poll Name: FYP leader</p> <p>Vote to: Chin Hsin Tien</p> <p>IC : <input type="text" value="556655665566"/></p> <p><input type="button" value="Get OTP"/></p> <p>Email sent</p> <p>OTP: <input type="text" value="476981"/></p> <p><input type="button" value="Vote"/> <input type="button" value="Reset"/></p>			
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Figure 1.5.8 Vote

- 9) **View voting progress and result:** All user is allowed to view the voting progress and result. The voter may check their vote is in the poll according the OTP they entered.

[Home](#)
[About Us](#)
[Contact Us](#)
[Admin Login](#)

Poll Name: FYP leader
Poll Description: Please Vote me
Start At: 8/31/2020 4:00:00 AM
End At: 9/8/2020 8:00:00 AM

The Poll is in progress!

 <p>ID: 8 Candidate: Chin Hsin Tien Description: Im boss Vote Received: 2</p>	 <p>ID: 9 Candidate: Chin Hsin Tien Description: vote me Vote Received: 0</p>
 <p>ID: 10 Candidate: Handsome Chin Description: My name is Edwin Chin Vote Received: 0</p>	

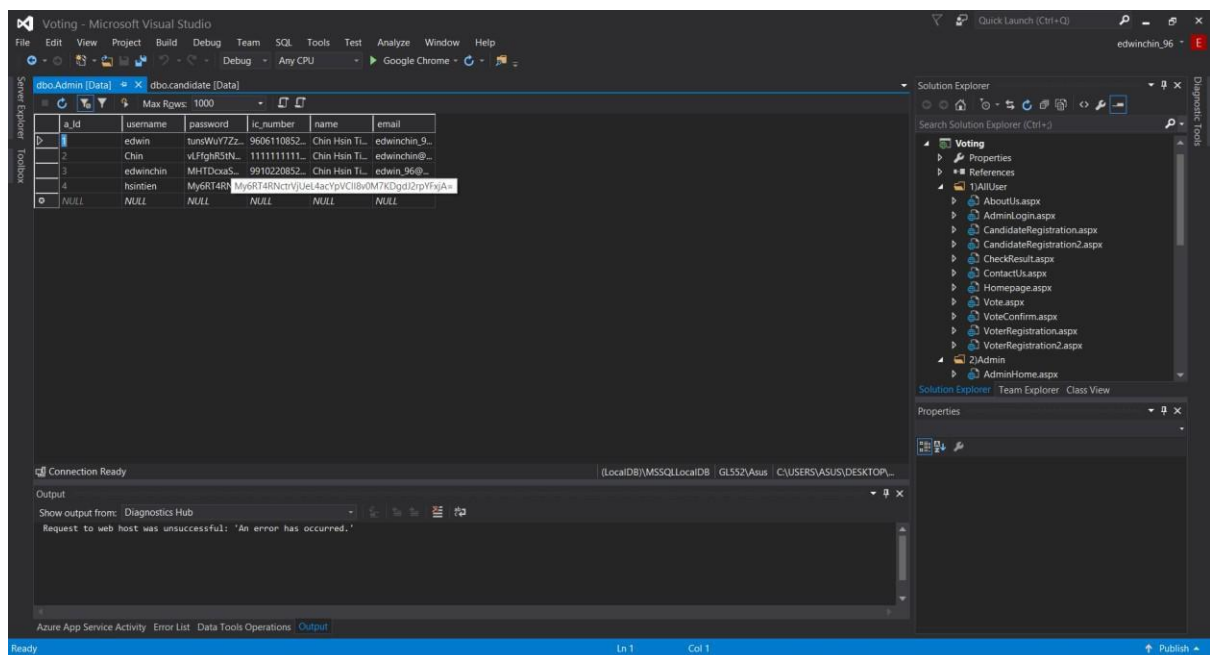
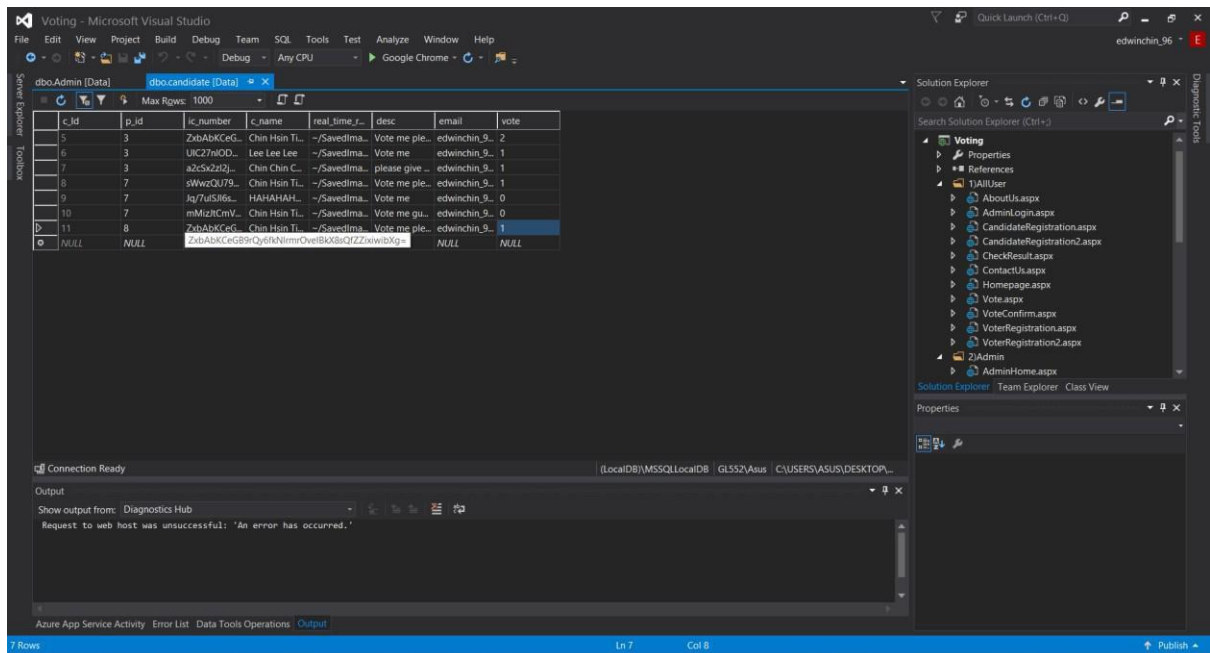
OTP Search:

OTP	Vote to Candidate ID
476931	8
476981	8

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Figure 1.5.9 View voting progress and result

- 10) **Hashing function for sensitive data:** Hashing function SHA-256 is apply to sensitive data such as voter's IC number, candidate's IC number and adminpassword.



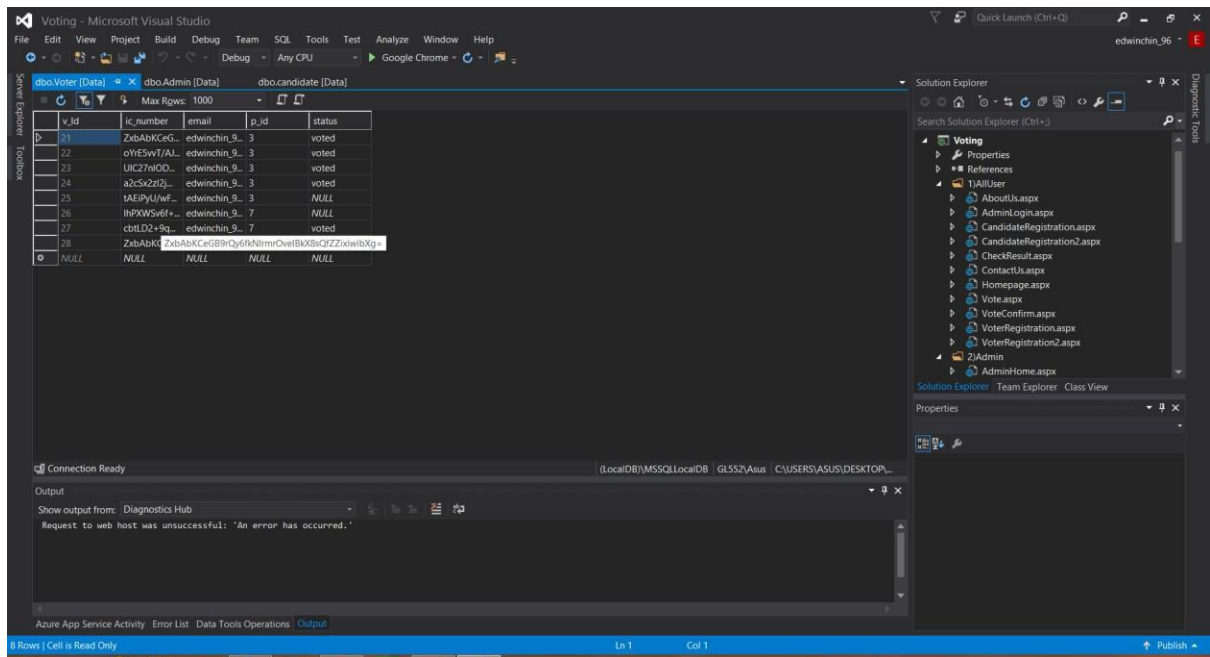
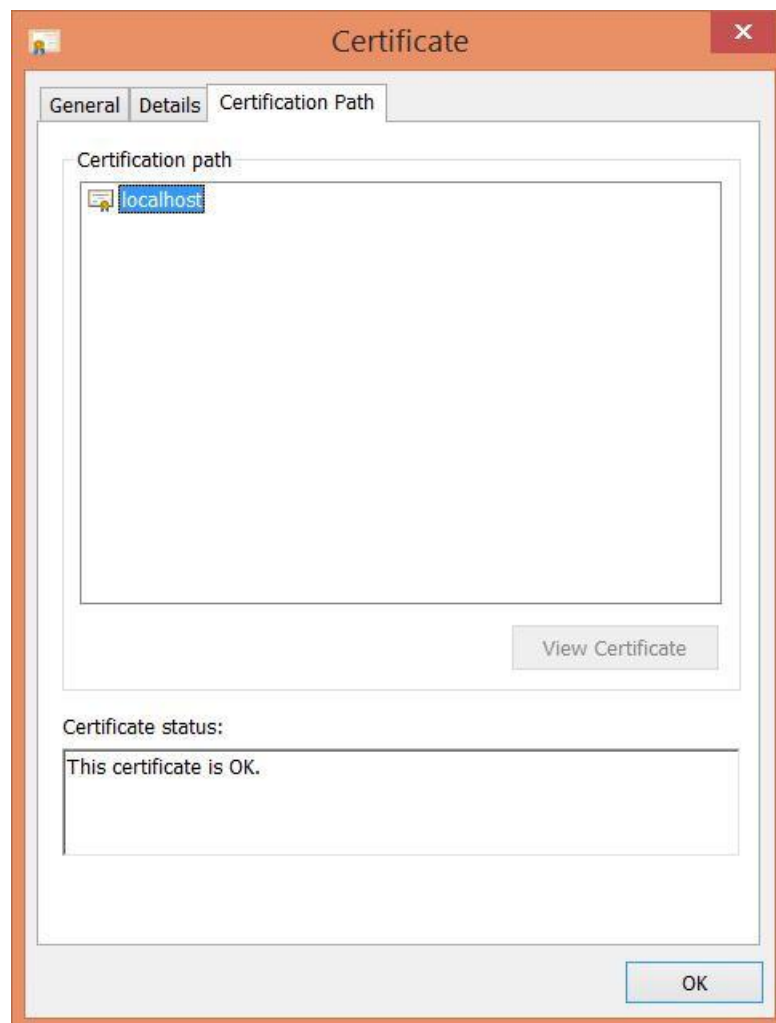
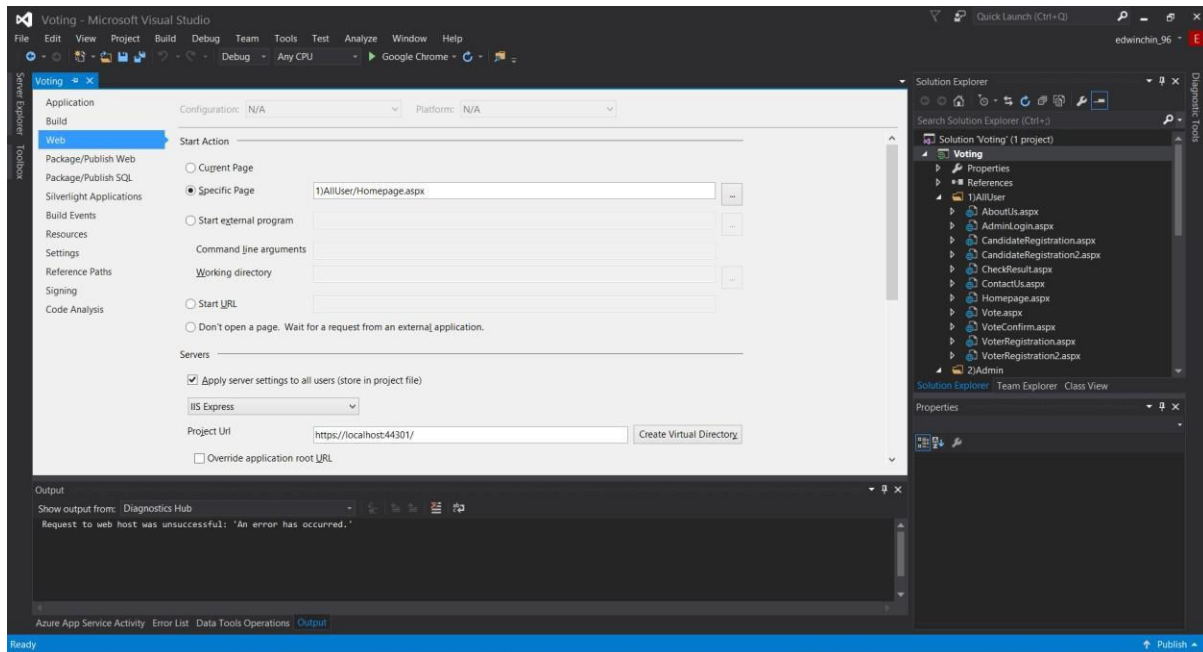


Figure 1.5.10 Hashing function for sensitive data

11) **Apply SSL certificate for HTTPS:** Apply SSL certificate and allow the web application to browse by using HTTPS.



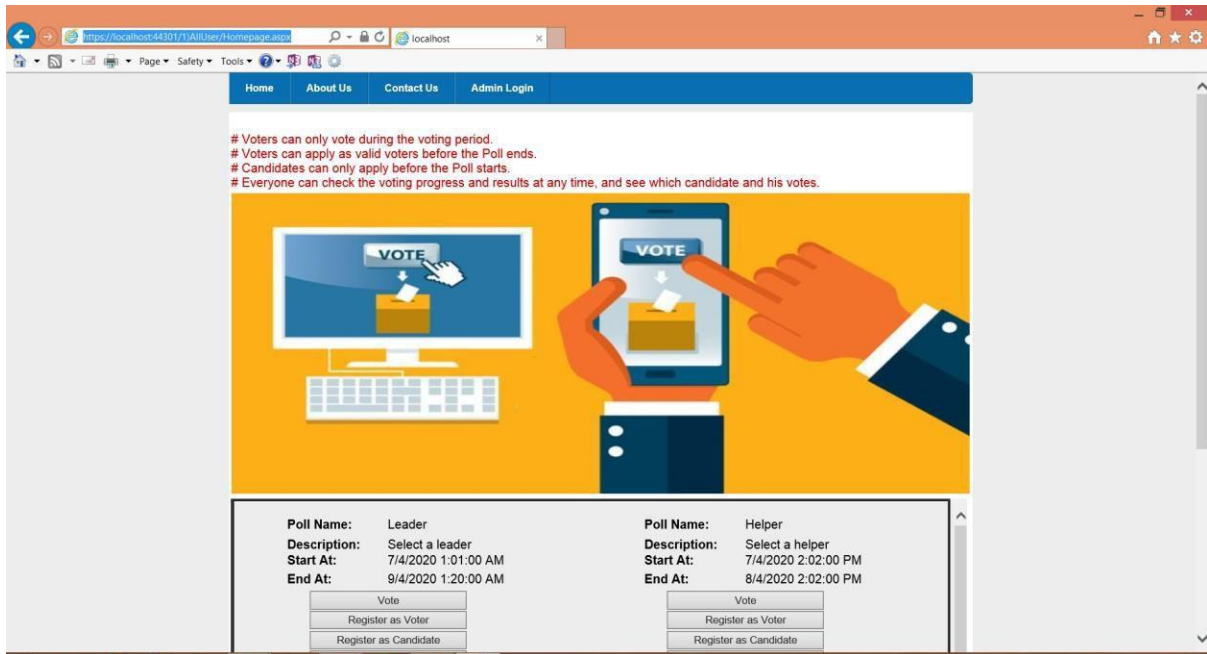


Figure 1.5.11 Apply SSL certificate for HTTPS

Chapter 2: Literature Review

2.1 Simple E-voting System in PHP

This is an E-voting system in PHP by PHPTPOINT in 2017. The objective for this project is because they understand that the modern internet brings a lot of convenience and benefits to people such as online banking system, online food ordering system and so on. But there was no such online voting system available for government to use for election. Therefore, it was a challenge for government to motivate the people to participate the election system and vote.

To solve this problem, their solutions is come up with a e-voting system by using PHP. They think the e-voting system can be done very efficiently with PHP software because PHP is a simple, elegant and powerful software development tool which is widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML. Besides that, PHP is also a safe, fast and reliable server-side scripting language for user to design and create a dynamic pages and applications. Therefore, it can fulfil many requirements for the e-voting system.

To this system, there are two different uses of admin and user. For the admin side, it allows the admin to modify the contents of the voting system freely, such as the information of the candidate and the user's information, and also can check for the number of votes and so on. For the users, it allows the users to register an id to vote a one-off vote for each section. The data will store in the database and there is some hash function for certain data, such as the users' password to protect the users' privacy.

Some features for this project are show below:

Users:

1. Admin
2. Voter

Table 2.1.1

Admin Features:

Voter Features:

<ol style="list-style-type: none">1. Login2. Manage Administrators3. Manage Candidates4. Manage Positions5. Check Poll Results6. Update Password7. Update Profile8. Logout	<ol style="list-style-type: none">1. Registration2. Login3. Update Profile4. Choose Positions for Voting5. Give Vote6. Logout
---	--

Critical Review:

In my opinion, from the overall of this e-voting system, it is indeed simple and applicable, and the complexity of the system is not very high. Therefore, it allows people to rebuild the system for their own easily so it can be more practically. But I think there are still some problems that this solution cannot fully solve it. Although PHP also have some hash functions to protect the user's data privacy, but not all data will be encrypted because of some data still need to be considered for detection by human action. Besides that, this system also cannot identify the user's registration is legitimate and only one account available for each people. At last but not least, the most important problem is the admin's power is very large, and we can't guarantee the fairness of the voting.

2.2 Advanced E-Voting Application Using Android Platform

This is a e-voting application by using android platform that created by Ganaraj K in 2017.

The objective for this project is because he understands that paper-based voting system needs much man power and a lot of resources to progress. Therefore, to overcome this problem, the e-voting system in android platform is an efficient way and also provide the users to vote with their smart phone.

In order to overcome the security issues, the user accounts have to provide e-mail address for registration and the e-voting system will use e-mail service to provide the secure password to user. Therefore, it can determine that email is valid and not duplicated. Besides that, the system used the Java Cryptology Extension algorithm to encrypt the vote and sent to admin hence it become a secured data that stored in database because the database can only access by the admin. Java Cryptology Extension algorithm is a set of Java API that provides a framework and implementation for encryption, key generation and key agreement, and Message Authentication code algorithm. Furthermore, the aadhar-id which is the unique number that can identifier the user uniquely and also some flag to indicating the user's status to avoid the user revote again.

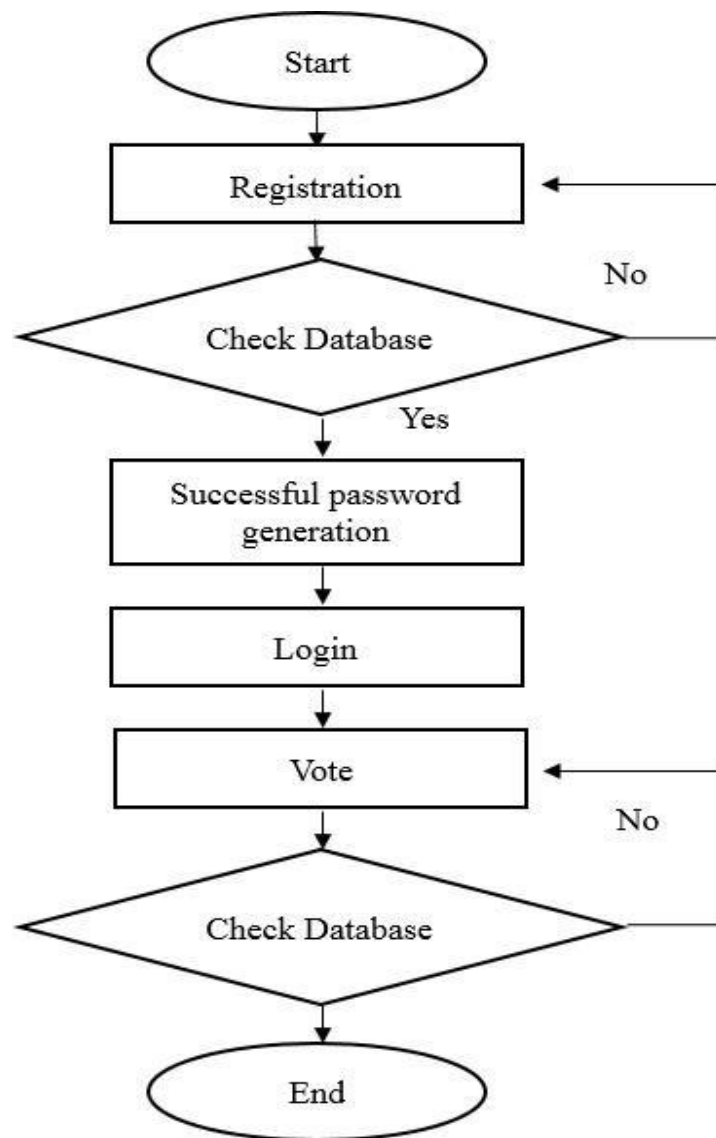
The modules for this project are show below:

1. Administrator
2. User
3. Account

Table 2.2.1

Administrator	User	Account
1. Manage user Information	1. Update Profile	1. Registration
2. Manage user Verification	2. Vote	2. E-mail Verification
3. Manage voting Information	3. Encryption	3. Login
	4. Check poll result	4. Logout

Figure 2.2.1: Flow Chart: Advanced E-Voting Application Using Android Platform



Critical Review:

In my opinion, this system is very convenient because of using the android platform and it also solve some security issues such as data privacy by using Java Cryptology Extension algorithm to encrypt, avoid the user to re-vote, user identified by unique id and valid user verification by e-mail and so on. But it still has some problems in this existing system which are the admin is still has a very large power that can manage the information in the system hence we cannot ensure the fairness of the voting. Besides that, and also because of using e-mail verification, some information is still not encrypted, thus the hackers are allowed to steal some information through the e-mail. Last but not least, the system cannot validate the user's registration are legitimate for voting because the system is only check for the valid email.

2.3 KCC SSAO E-Voting System

This is an E-voting system created by joken using Visual Basic 2008 and Microsoft Access 2007. For this system, it contains a desktop graphically user interface and have a friendly user interface for user to interact with the system. The objective for this system is to let the students from Kabankalan Catholic College can vote conveniently by using computer or laptop through the internet from any location.

In order to solve the security issues, this system have to connect to the database that possess all the students' information of the Kebankalan Catholic College as a validation method for the students when register an account to vote. Therefore, it can make sure that the user's registration is validate and legitimate. Besides that, the system will generate a unique id according to their registration details by using an algorithm after they have registered successfully. This unique id is an anonymous function to hide the voters' information after they vote and also can prevent the user re-vote by checking the unique id. Furthermore, the admin is the only power to access the system. Thus, the system can determine the user's role during the login process and lead the user to the corresponding functionality and features of the system. In addition, if the voters try to attack or play the system, a security password is required to access.

Some features of this system are show below:

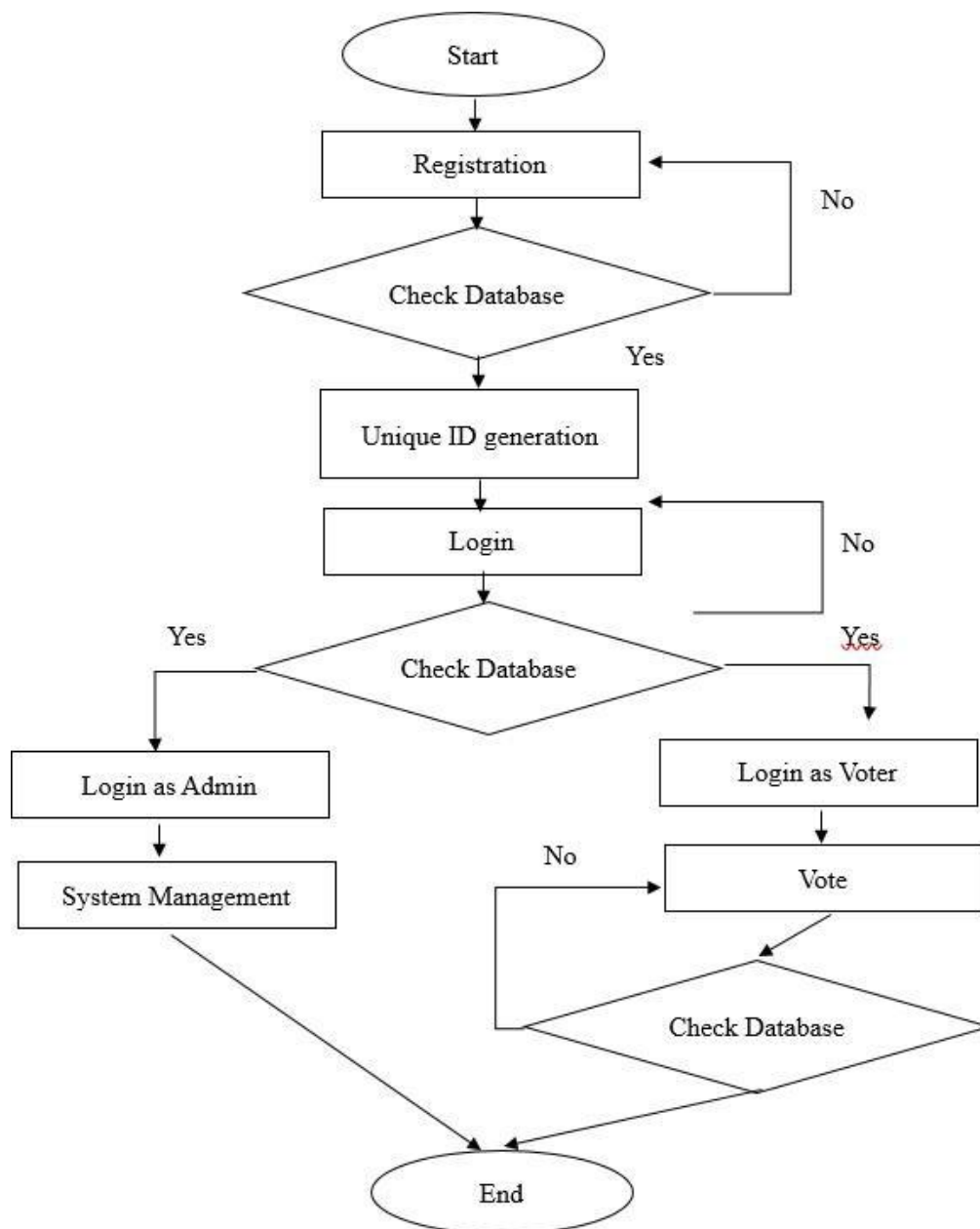
Users:

3. Admin
4. Voter

Table 2.3.1

Admin	Voter/ User
1. Manage Candidate Information	1. Registration
2. Manage Voter Information	2. One-Off vote
3. Check Voter Status	
4. Manage Voting Information	

Figure 2.3.1: Flow Chart: KCC SSAO E-Voting System



Critical Review:

In my opinion, this system is very advanced since it solved a lot of security issues such as user verification to determine the users are legitimate and validate with the database when register an account. Besides that, a unique id to represent a voter details can protect the user's privacy and also check the voter's status to prevent the user to re-vote. The admin is the only power that can access to the system management and it required a security password to prevent the other users that try to attack or play the systems. But there are still have some problem in these solutions. Since the admin have the power to manage the voting information, we cannot ensure the fairness of the voting. Furthermore, however the system has provided the unique id for the voters but the admin may also steal the users' information because they have the power to access the system management and check the voters' information because the information is not encrypted from database.

2.4 Nevon Project- Online Election System

This is an E-voting system by using SQL and Visual Studio 2010 for election purpose that created by Nevon Project. This system has 3 roles which are admin, candidates and voters. Different role got their own different functionalities and features. The admin login will be handled by election commission, candidates can log in by themselves and voter will get a unique id for voting to prevent re-vote.

In order to solve the security issues, the admin can check the candidates and voters' information and verify the document, thus the candidates' id and password will only be generated to avoid the illegal account. Besides that, the admin is not allowed to manage the voting information hence to make the voting fairer. Therefore, the admin can only create an election and preview the voting result, and the result will auto be released after 2 hours. The legitimate candidates can manage their own profile even upload all their details including their previous milestone onto the systems. The voter can only log in to the system and vote for a candidate only once for each election.

Some features for this system are show below:

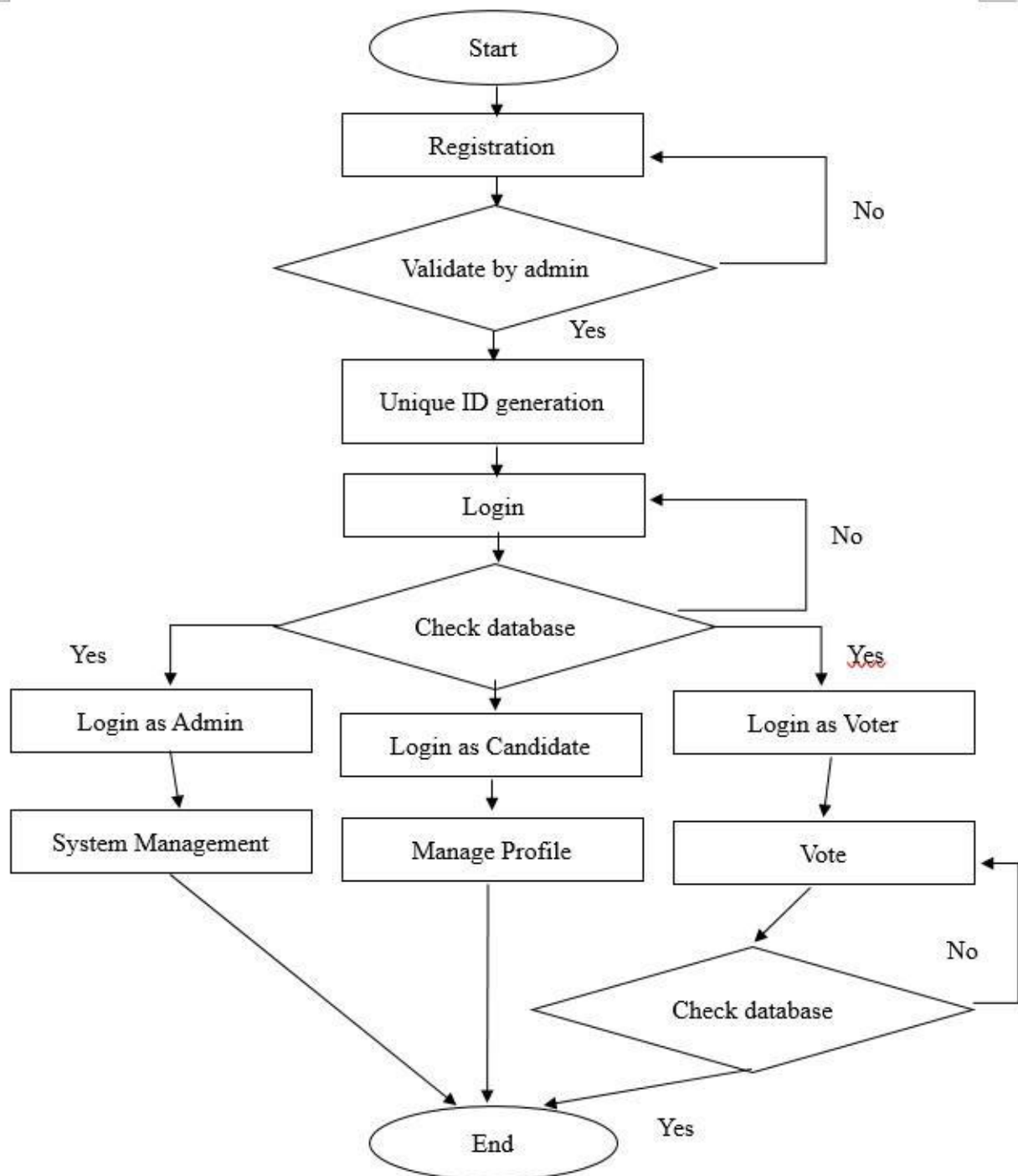
User:

1. Admin
2. Candidate
3. Voter

Table 2.4.1

Admin	Candidate	Voter
1. Login 2. Candidate Document Verification 3. Create an election 4. Preview the voting result	1. Registration 2. Login 3. Manage Profile 4. View voting result	1. Registration 2. Login 3. View candidate's data 4. Vote 5. View voting results

Figure 2.4.1: Flow Chart: Nevon Project- Online Election System



Critical Review:

In my opinion, this system is a very simple and convenient because the admin can fast and easy to conduct an election. Besides that, some features that only can be done by election commission and admins are also controlled by them, thus to reduce the chance that admin may steal the users' information or modify the voting result illegally. Therefore, it can enhance the security of the system in certain situation. But there are still some weaknesses for this system which are the system is still got chances of hacking candidates or voters account. Because of the users' registration are validate by the admin and without any encryption, the voters' information is easier to be stolen by others. Furthermore, the system is still possible for someone to modify the voting information that lead unfairness voting because the election commission is still got the system management power and also the final decision maker.

2.5 E-voting System Java Swing Project

This is an e-voting system that created by MRTECH RN by using JAVA in 2018. The objectives for this system are to emphasize digital systems and reduce paper-based system, to describe the digital system is faster, more efficient, more durable and no wrong room.

Besides that, this system only has 2 roles which are admin and voters.

In order to solve the security issues, this system is not allowing the users to register by themselves. Therefore, it can reduce the fault account occur and avoid the illegal users. When admin login to this system, it required the admin id and also the password to access. In addition, a candidate's id, voter id even an admin id can only register by an existing admin account, therefore this e-voting system is still need to physically supervised by representatives of government or independent electronical authorities at polling station.

Furthermore, admin is the only power to manage the whole system. After the voter's account had been registered, a unique id will be generated for user to log in by using it without any password require. This method provides the anonymous function that can solve the privacy problem during the voting process. But the admin still can check the user's information based on the unique id which that provided.

Some feature for this system is show below:

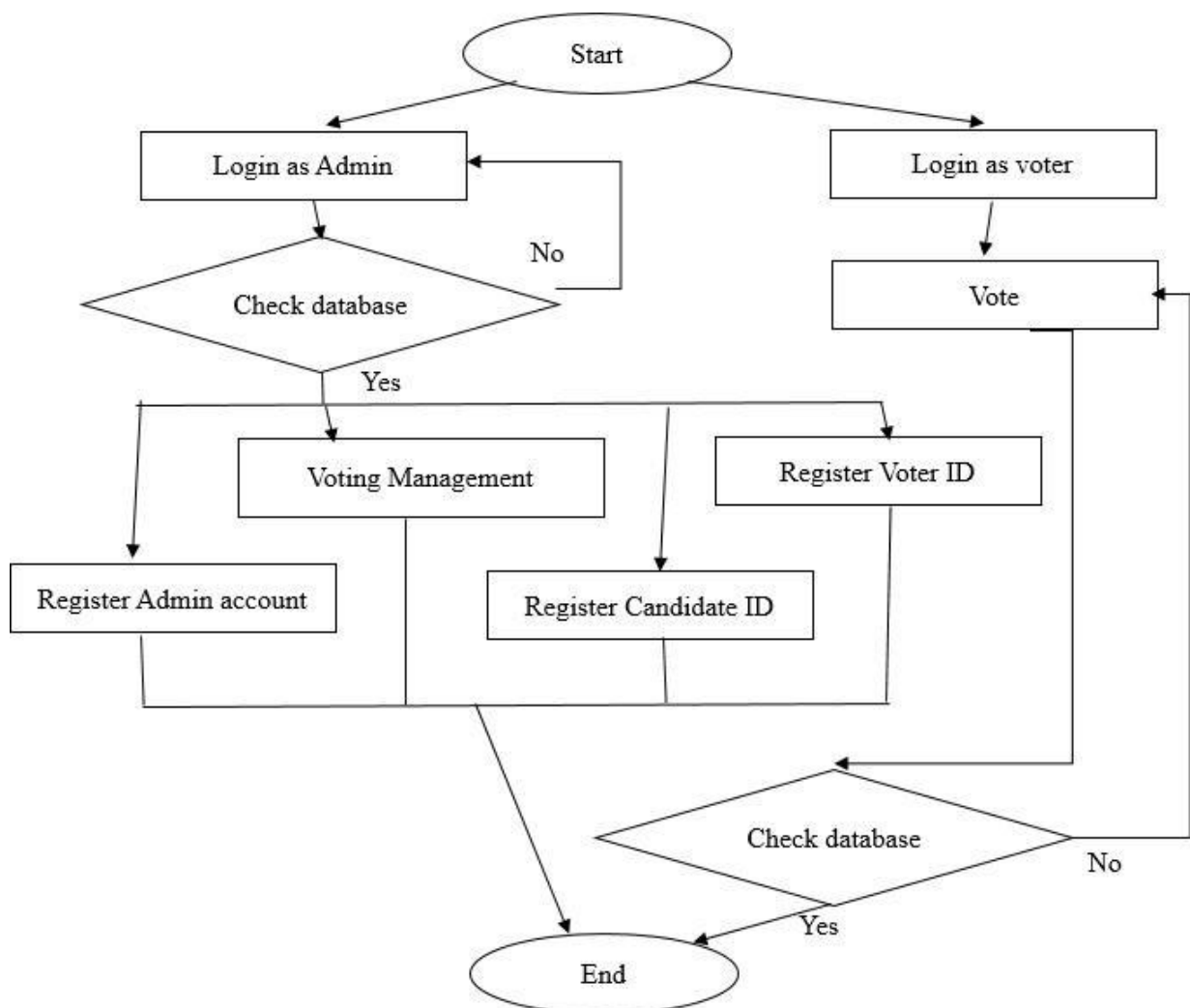
User:

1. Admin
2. Voter

Table 2.5.1

Admin	Voter
<ol style="list-style-type: none">1. Register the name list of the voters2. Register the candidates3. Register new admin id4. Set the Voting duration5. Display result6. Generate Voter cards	<ol style="list-style-type: none">1. Log in by unique id which is provided2. Vote

Figure 2.5.1: Flow Chart: E-voting System Java Swing Project



Critical Review:

In my opinion, this system got better security because that this system still needs the physically supervised by government representatives or electronical authorities and the voters can only login by using the unique id which is provided and one-off vote, that's all. By having this method can prevent a lot of fault account or illegal users occur. But this system is still got chances of hacking candidate and voters' information since that all the data are stored in the database without any encryption. Besides that, the admin got very large power and also allowed to manage the voting information which might affect the voting fairness.

2.6 Comparison of these 5 existing E-voting System with current system

- 1. Simple E-voting System in PHP**
- 2. Advanced E-Voting Application Using Android Platform**
- 3. KCC SSAO E-Voting System**
- 4. Nevon Project- Online Election System**
- 5. E-voting System Java Swing Project**
- 6. An E-Voting Application Using Cryptography Technology (My project)**

Table 2.6.1

Systems Functionalities	1	2	3	4	5	6 *
Admin						
System Management	✓	✓	✓	✓	✓	✓
Candidate Management	✓	✓	✓	✓	✓	✓
Voter Management	✓	✓	✓	✓	✓	✓
Voting Management	✓	✓	✓		✓	✓
Candidate						
Registration				✓		✓
Login				✓		
Profile Management				✓		
Vote				✓		
Preview Result				✓		✓

Voter						
Registration	✓	✓	✓	✓		✓
Login	✓	✓	✓	✓	✓	
Profile Management	✓	✓		✓		
View Candidate Info	✓	✓		✓		✓
Vote	✓	✓	✓	✓	✓	✓
Preview Result		✓		✓		✓
System / Security						
HTTP	✓	✓	✓	✓	✓	
HTTPS						✓
Encryption	✓	✓				✓
User Authentication	✓	✓	✓	✓	✓	✓
Email Validation						✓
Captcha						✓
OTP						✓
Data Validation			✓	✓		✓

The comparison table is my personal opinion after testing these systems and compare with my project. In these systems, user-friendliness is also very good, so it is easier for people to vote. However, in order to authenticate users through the Internet, the data privacy and encryption of the system are affected, so there is still an opportunity for hackers to invade user accounts. The only system with high hack avoidance and user verification capabilities must be physically supervised by government representatives at polling stations or

independent electronic authorities. The last but not least point is that the security inspection and data confidentiality of the voting system are still not perfect, and the biggest difference with the system of this project is that voters cannot check whether their votes are counted and visible. But this e-voting system has this feature, because of the function of OTP and also store the OTP that represent their votes in an isolate table with the voters' data, voters can clearly see that the votes they voted are counted in the poll, and they are still in anonymous mode. Only the voters themselves will know, even the system administrator will not know.

2.7 Why the proposed system in this project is better than the existing system

There are not many existing e-voting applications, but each application has its own characteristics and methods. However, those systems may have loopholes and allow hackers to invade, modify or steal data. In order to simplify the system, the security measures of these systems are not perfect. Therefore, cybercrime cases will occur more easily and frequently. For example, hackers can use malicious attack, phishing, spamming and so on to steal the information from the system. In addition, although some existing systems are simple to use to achieve user friendly, their security measures are relatively weak, otherwise a more complex existing systems is also more complicated to use, which will also cause users to be unable or impatient to use the application.

From the above, we can conclude that this proposed system in this project is better because:

1) Better security measures - OTP,Captcha, Data verification

By using OTP (One time password), Captcha and Data verification to avoid hacker to hack the system by using looping function or other technology to crack the system easily.

2) Faster and easier to use - User friendly, Webcam capture, Type less

In order to make the application easy to use, the system will minimize the need for user input while considering system security. This allows users to be faster and more convenient to use, and the admin of the application can also effectively check the authenticity of the user by using webcam live capture.

3) Safer database- Encrypted data for sensitive information

In order to ensure the security of user's sensitive data, sensitive data will be encrypted (hashed) before being stored in the database.

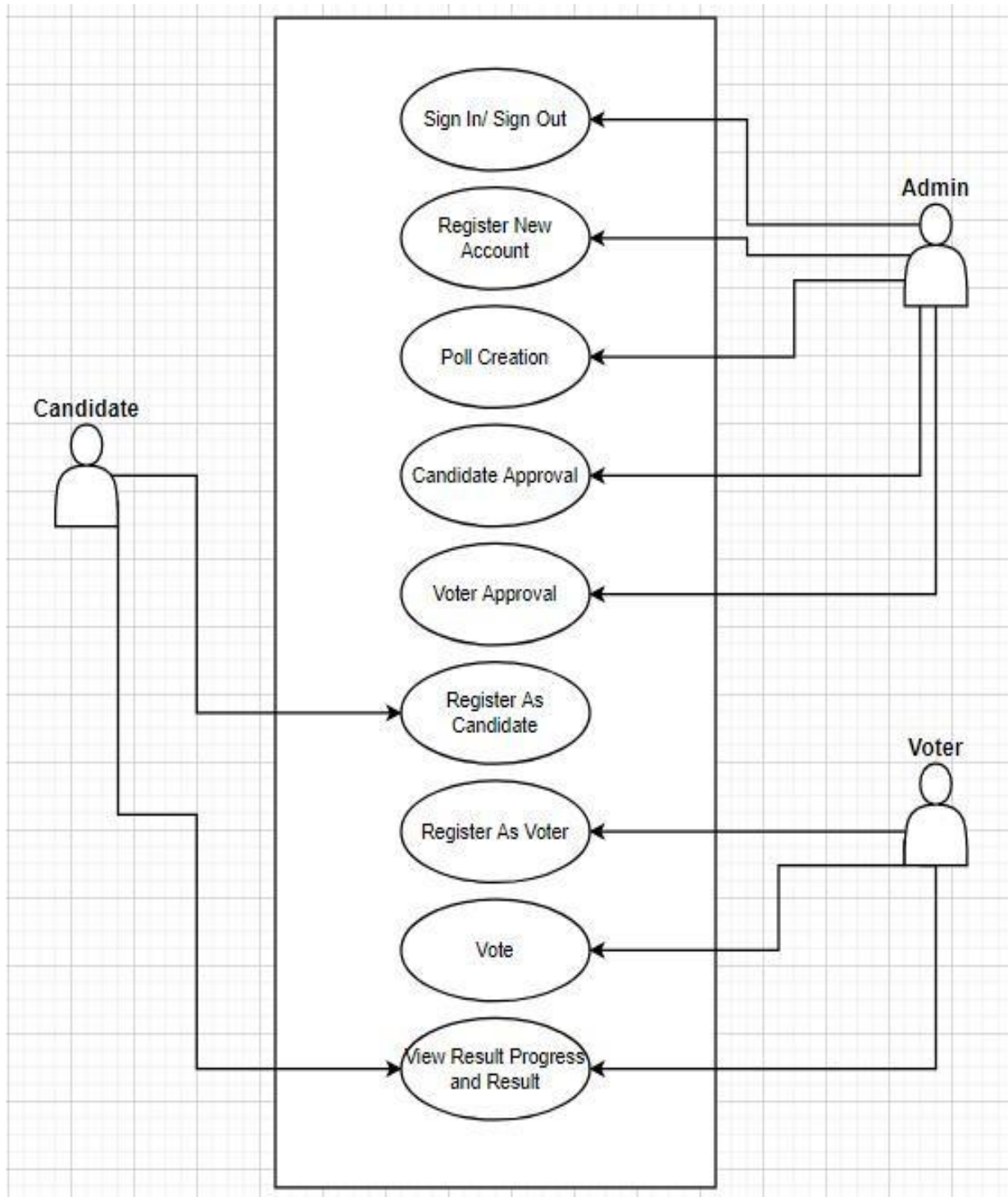
4) Secure connection with the system- Using SSL certificate for HTTPS

By using HTTPS (Secure version of HTTP), it is encrypted in order to increase security of data server between a web browser and a website.

Chapter 3: System Design

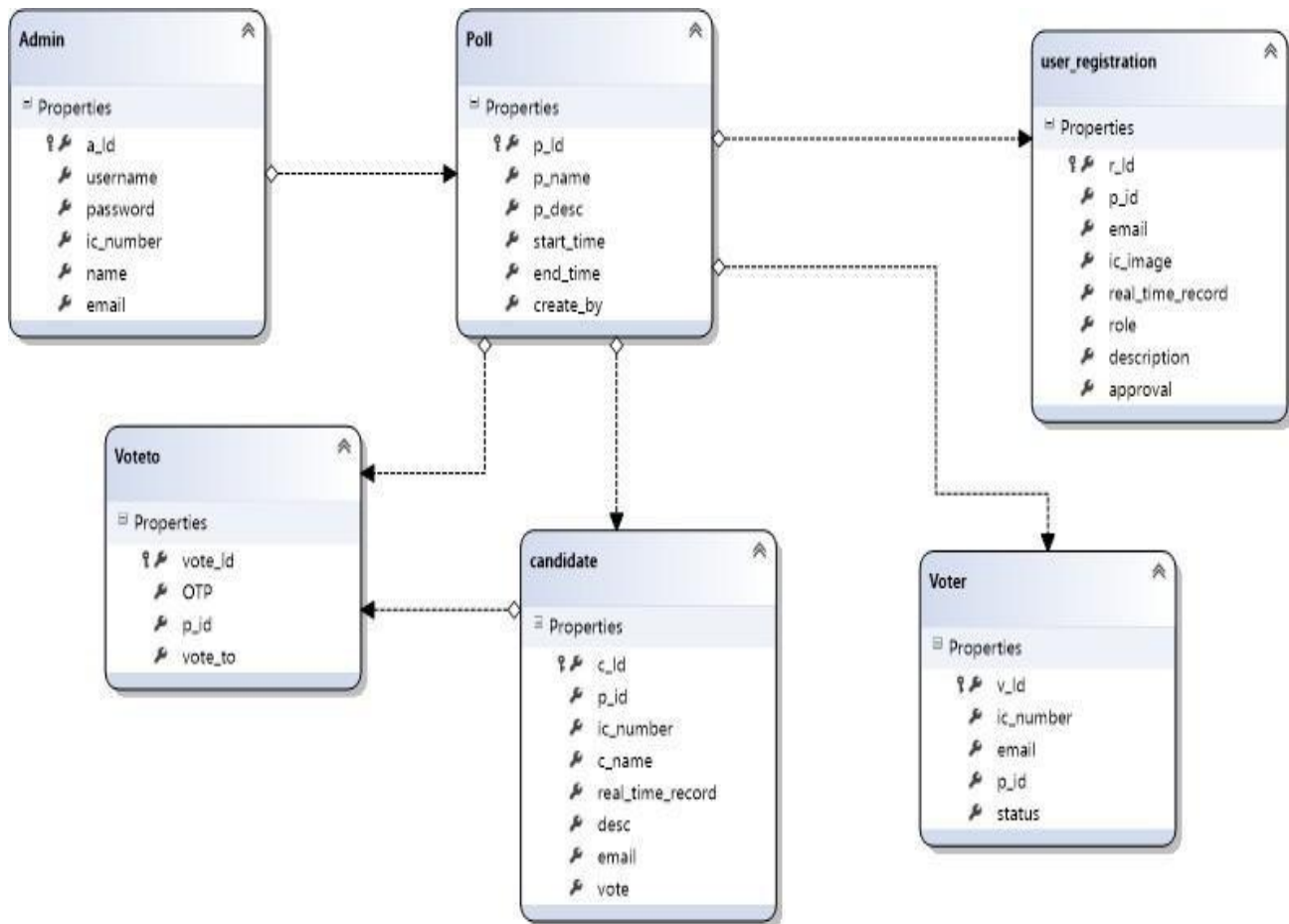
3.1 Use Case Diagram (E- Voting System)

Figure 3.1.1:Use Case Diagram (E- Voting System)



3.2 ERD Diagram (E- Voting System)

Figure 3.2.1: ERD Diagram (E- Voting System)



3.2.1

Table Name: Admin

Column Name	Description	Data Type	Size	Constraints	PK/FK	References To
a_id	Admin' ID	int		NOT NULL	PK	
username	Admin's Username	nvarchar	50			
password	Admin Username's Password	nvarchar	MAX			
ic_number	Admin's IC Number	nvarchar	50			
name	Admin's name	nvarchar	50			
email	Admin's email	nvarchar	50			

3.2.2

Table Name: Poll

Column Name	Description	Data Type	Size	Constraints	PK/FK	References To
p_id	Poll' ID	int		NOT NULL	PK	
p_name	Poll's name	nvarchar	50			
p_desc	Poll's Description	nvarchar	MAX			
start_time	Poll's start time	Datetime				
end_time	Poll's end time	Datetime				
create_by	Admin's id	int			FK	Admin (a_id)

3.2.3

Table Name: user_registration

Column Name	Description	Data Type	Size	Constraints	PK/FK	References To
r_id	User Registration's ID	int		NOT NULL	PK	
p_id	Poll's id	int			FK	Poll (p_id)
email	User's email	nvarchar	50			
ic_image	IC Image	nvarchar	50			
real_time_record	Real time face photo	nvarchar	MAX			
role	Registration's role	nvarchar	50			
description	Registration's description	nvarchar	MAX			
approval	Approval status	nvarchar	50		FK	Admin (a_id)

3.2.4

Table Name: candidate

Column Name	Description	Data Type	Size	Constraints	PK/FK	References To
c_id	Candidate' ID	int		NOT NULL	PK	
p_id	Poll's ID	int			FK	Poll (p_id)
ic_number	Candidate's IC number	nvarchar	50			
c_name	Candidate's name	nvarchar	50			
real_time_record	Candidate's face photo	nvarchar	MAX			
desc	Candidate's Description	nvarchar	MAX			
email	Candidate's email	nvarchar	50			
vote	Vote Earned	int				

3.2.5

Table Name: Voter

Column Name	Description	Data Type	Size	Constraints	PK/FK	References To
v_id	Voter' ID	int		NOT NULL	PK	
ic_number	Voter's IC number	nvarchar	MAX			
email	Voter's email	nvarchar	50			
p_id	Poll's id	int			FK	Poll (p_id)
status	Vote status	nvarchar	50			

3.2.6

Table Name: Voteto

Column Name	Description	Data Type	Size	Constraints	PK/FK	References To
vote_id	Vote' ID	int		NOT NULL	PK	
OTP	OTP	nvarchar	50			
p_id	Poll's id	int			FK	Poll (p_id)
vote_to	Candidate vote to	int			FK	candidate (c_id)

3.3 Flow Chart

Figure 3.3.1: Flow Chart (Candidate Registration)

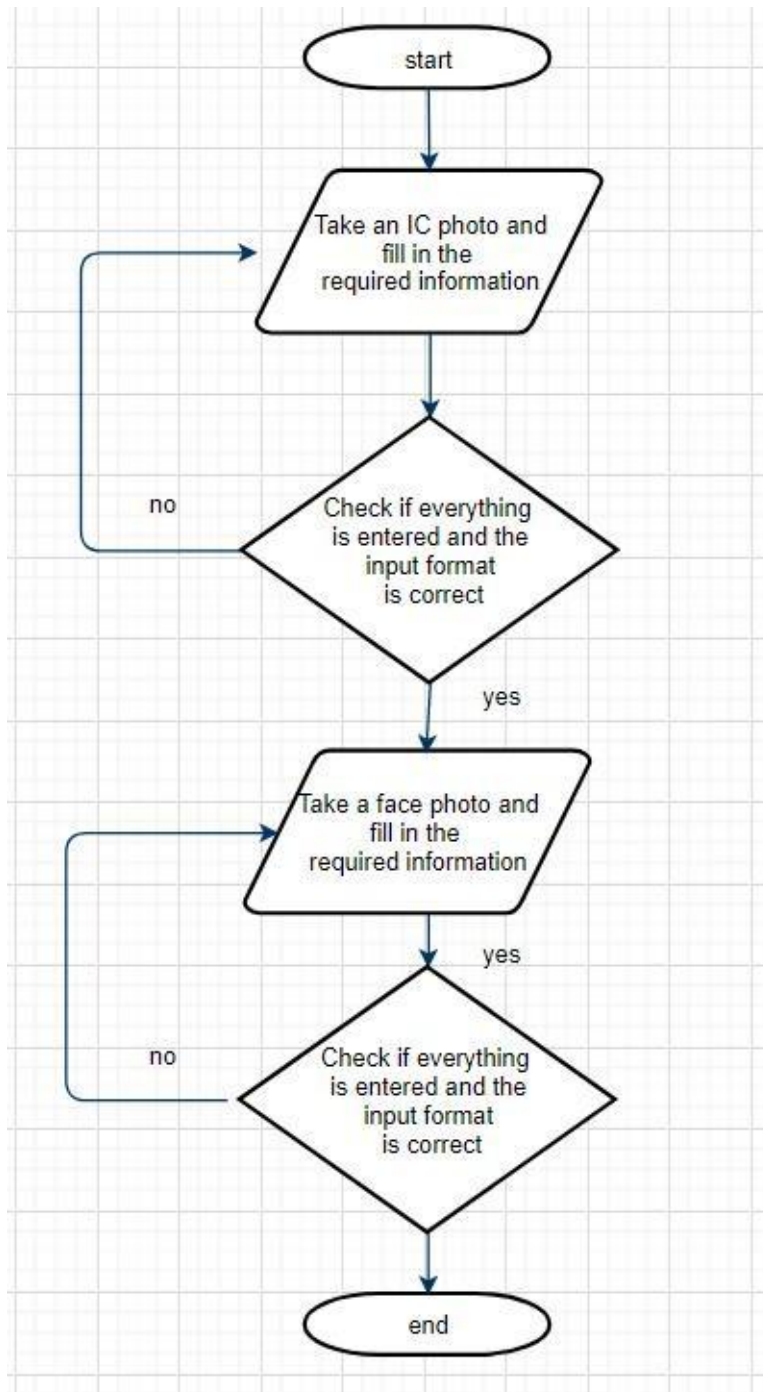


Figure 3.3.2: Flow Chart (Voter Registration)

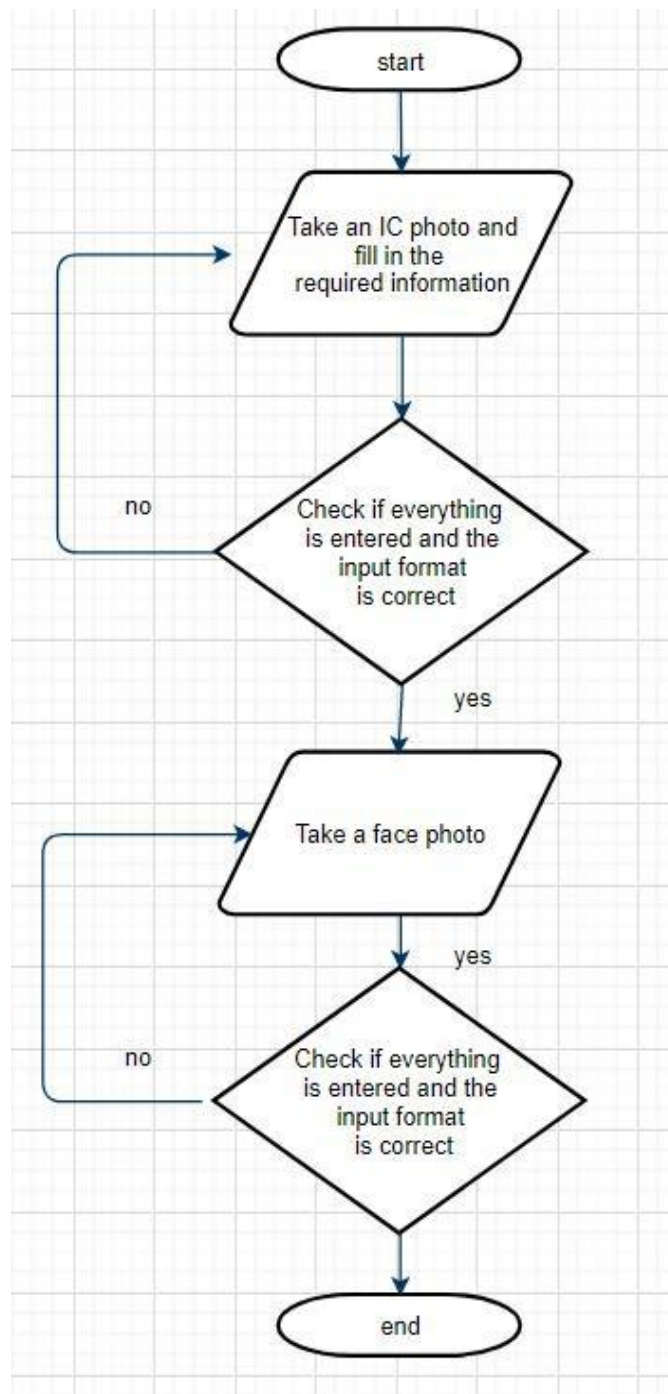


Figure 3.3.3: Flow Chart (Voting Process)

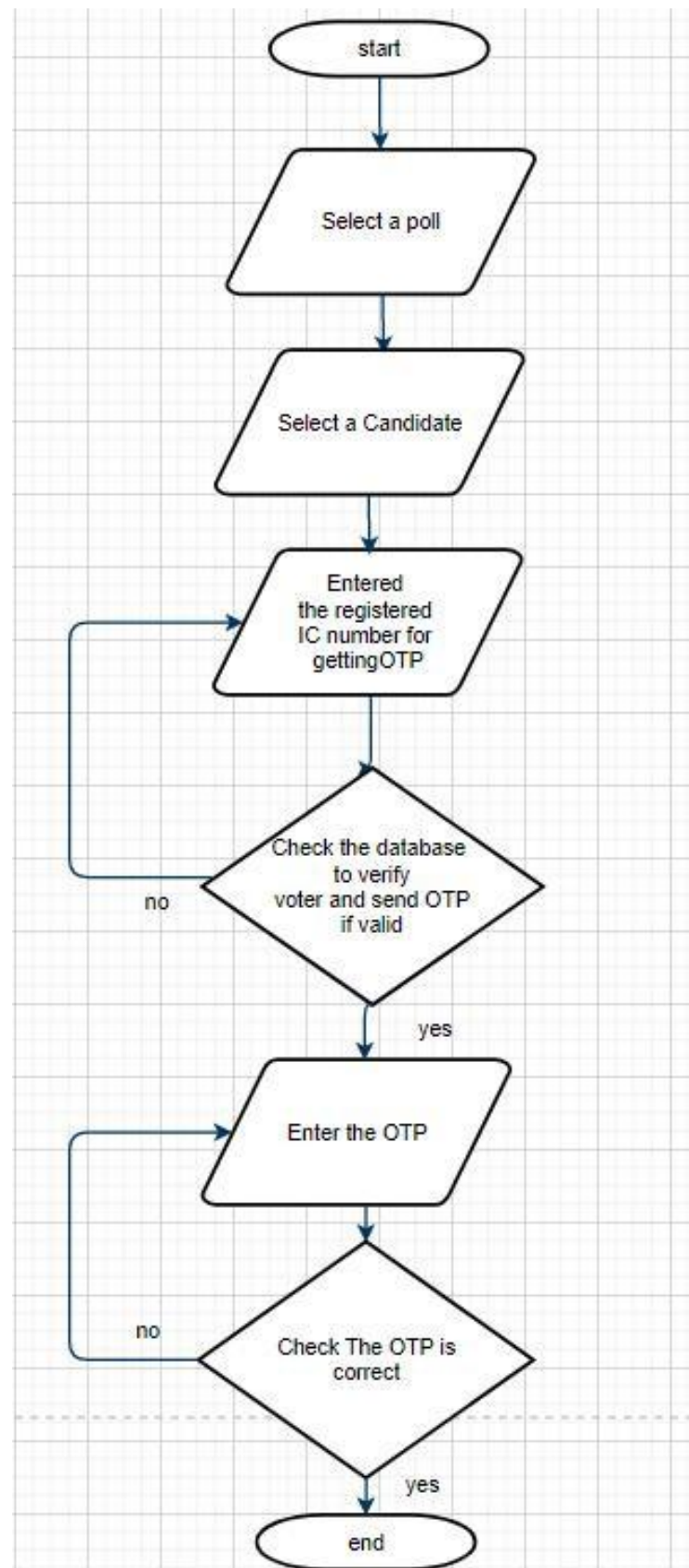


Figure 3.3.4: Flow Chart (Poll Creation)

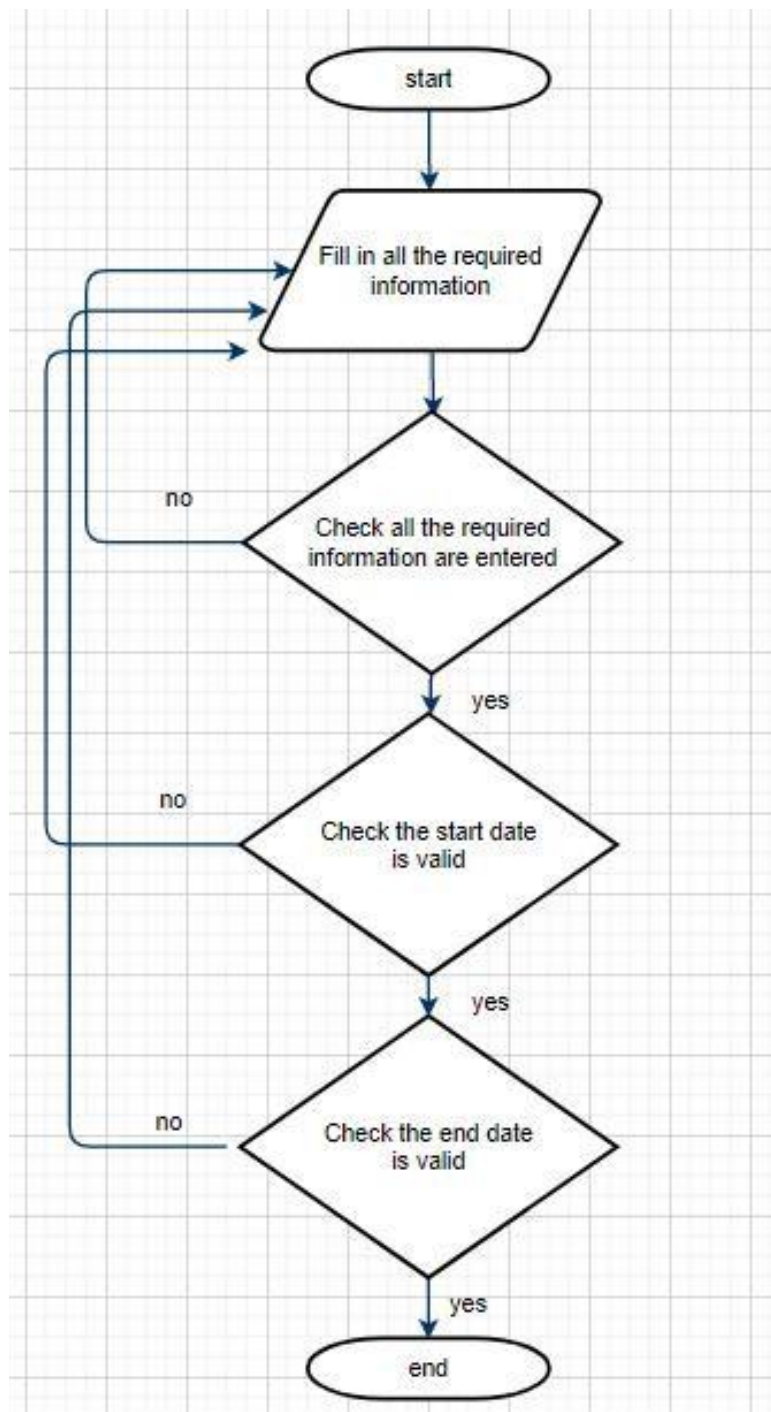


Figure 3.3.5: Flow Chart (Admin Login)

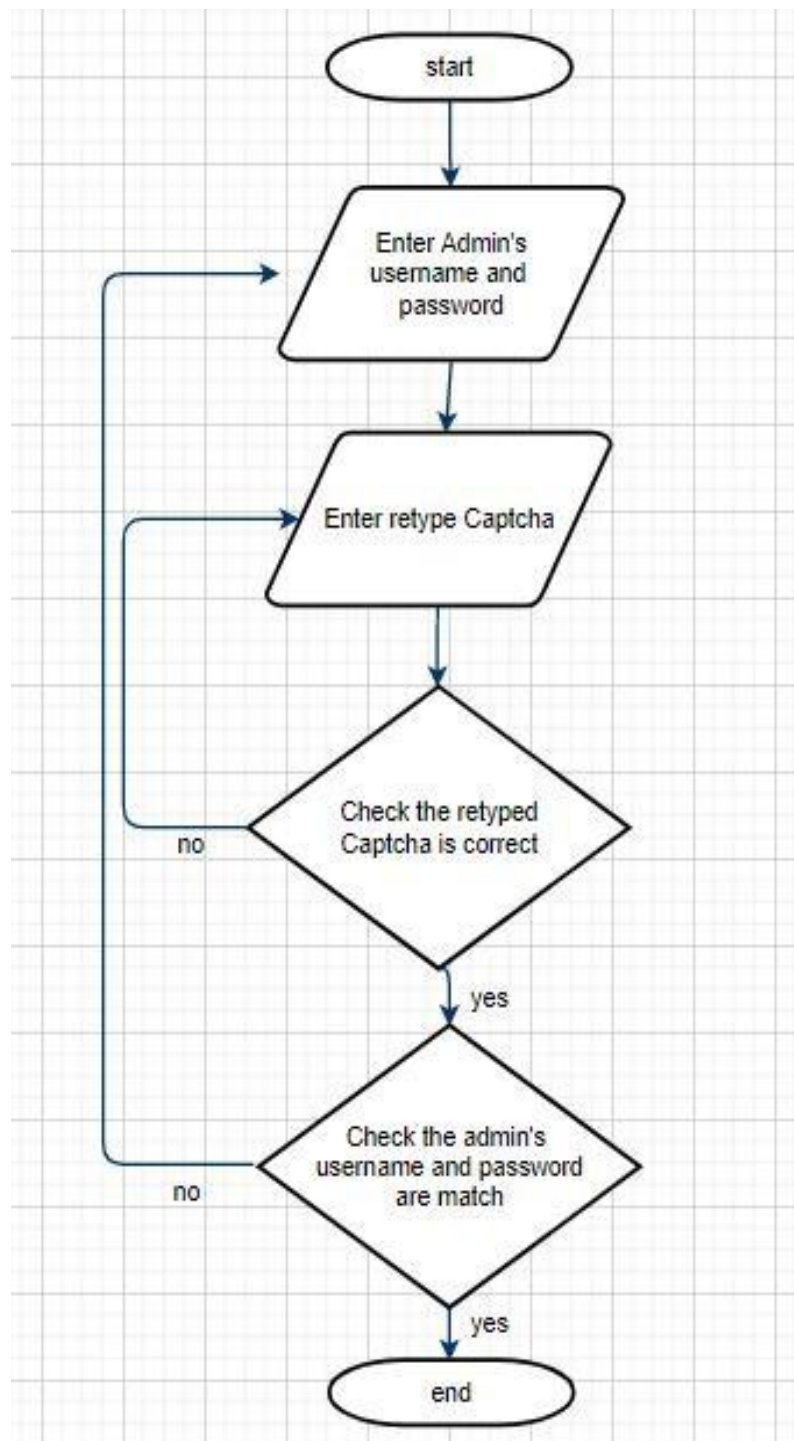


Figure 3.3.6: Flow Chart (Candidate Approval by admin)

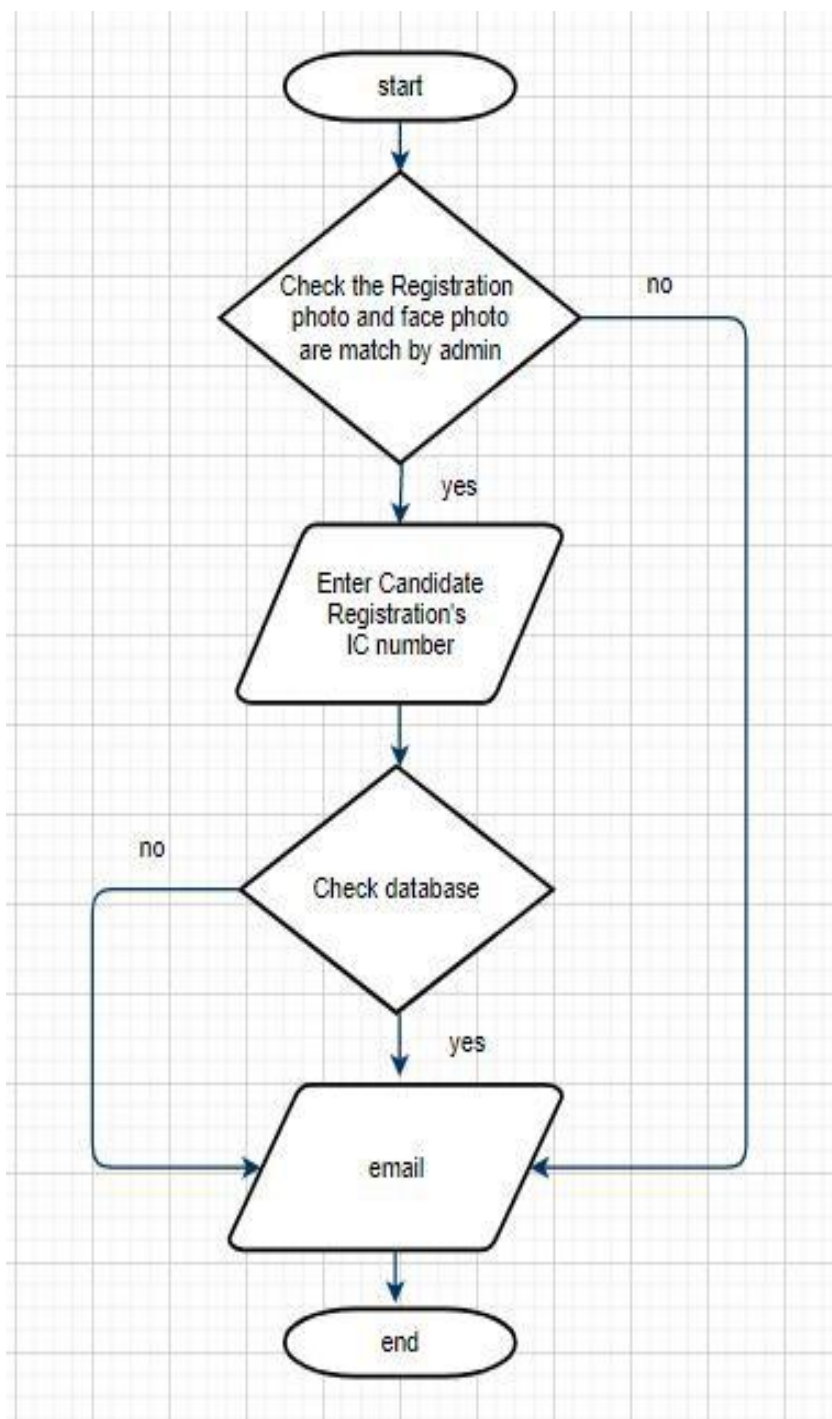


Figure 3.3.7: Flow Chart (Voter Approval by admin)

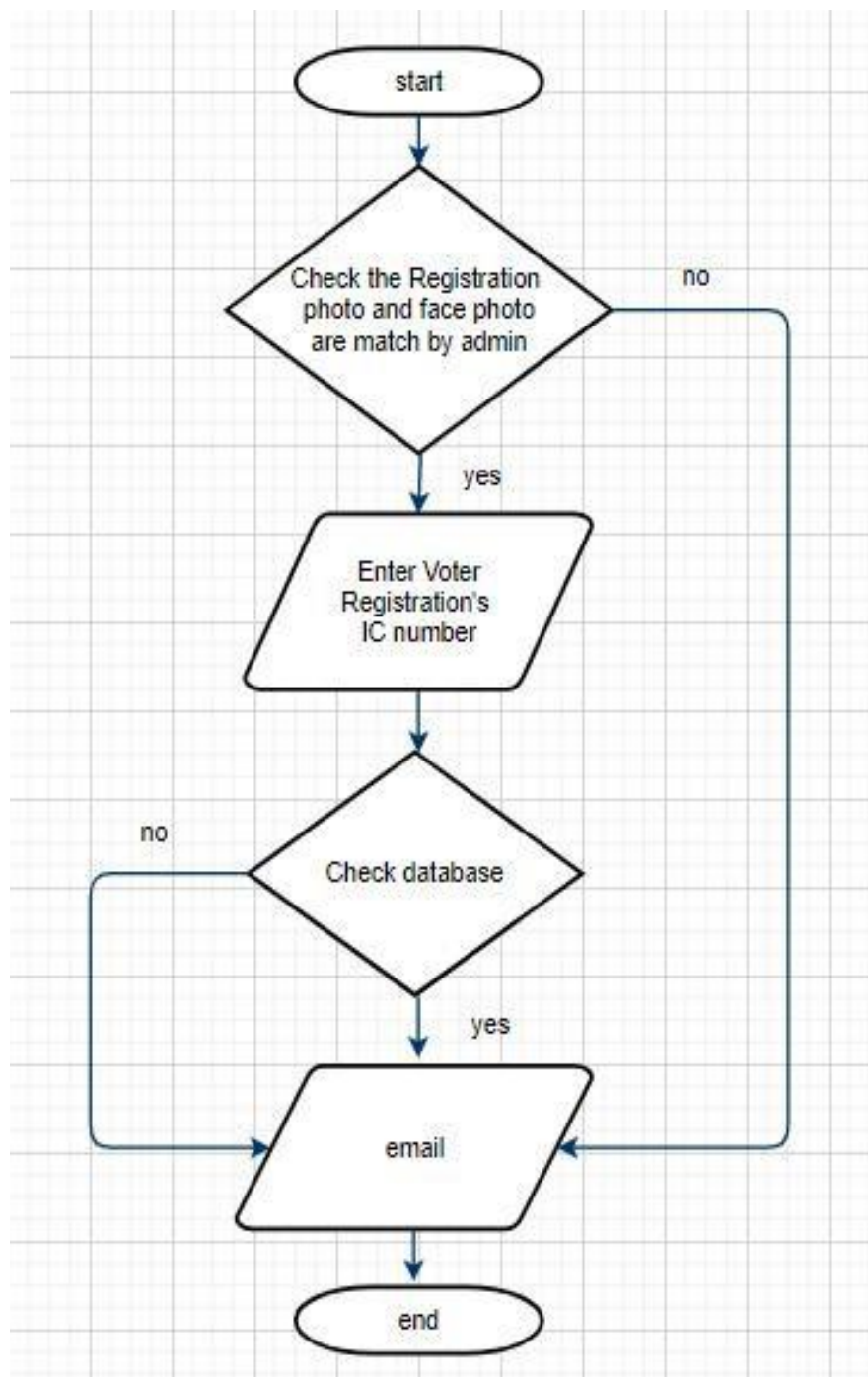
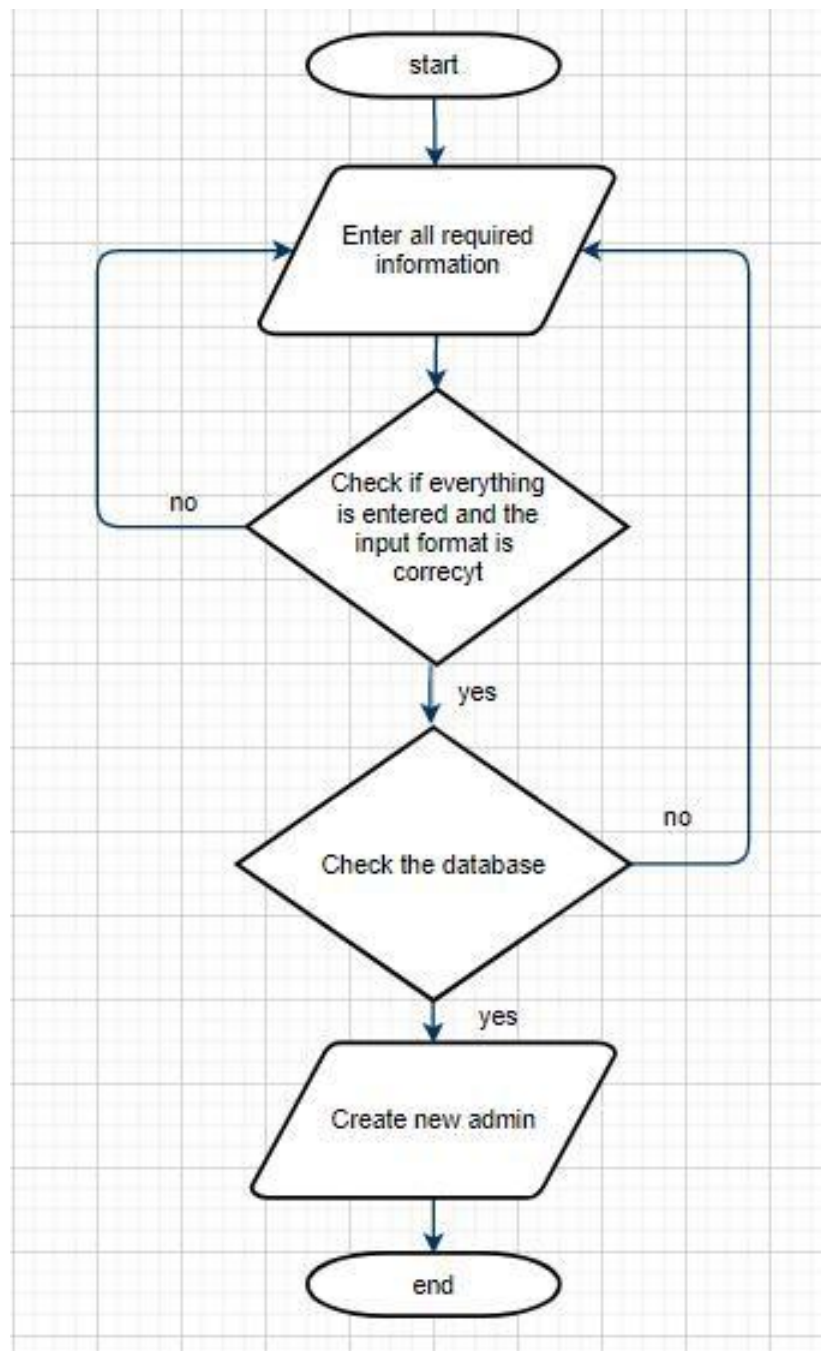


Figure 3.3.8: Flow Chart (Create a new admin)



3.4 Implementation Issues and Challenges

First, there are two challenges in completing this project. The first challenge is how to improve the security of the system, because the security of the system can greatly enhance the user's confidence in the use of the system. Therefore, in order to achieve the system requirements of the goal, I have conducted a lot of research on this, and selected technologies and methods that can be implemented and completed the task to be used in this project.

The second challenge is the confidentiality of the system. This is mainly to ensure that users can have very good confidentiality when using this system, for example, some users' sensitive information can be recognized by the system but others cannot recognize it. And in terms of voting, users can also confirm their own votes, but others cannot query. These methods all require some time and effort to complete.

Chapter 4: System Requirement

4.1 Methodologies and General Work Procedures

In order to complete an online voting system, we must select an Integrated Development Environment (IDE) that can be used to complete the system, and I will choose to use Visual Studio 2015 to complete this project. In this Visual Studio 2015, we will mainly prefer to use ASP.NET, C # (C-Sharp), JavaScript, Structured Query Language (SQL) and Cascading Style Sheets (CSS) to complete the interface and functions of various web pages. Therefore, Visual Studio 2015 must install features such as ASP.Net, SQL database and further features to complete the minimum requirements for this project.

4.2 Tools to use

Table 4.2 Tools to use

Software:

Hardware:

1. Visual Studio 2015	1. 1.5 GB of RAM and above
2. ASP.Net	2. 1.6 GHz or faster processor
3. C# (C Sharp)	3. Network supply
4. JavaScript	4. 5400 RPM hard disk drive
5. CSS (Cascading Style Sheets)	5. 4 GB of available hard disk space
6. SQL (Structured Query Language)	6. DirectX 9- capable video card (1024x768 or higher resolution)
7. Local Storage (SQL Database)	
8. SSL Certificate	

4.3 User Requirements

Table 4.3 User Requirements

Admin	Candidate	Voter
<ol style="list-style-type: none">1. Login/ Logout2. Register3. Candidate Registration Approval4. Voter Registration Approval5. Poll Creation	<ol style="list-style-type: none">1. Register2. View voting progress and result	<ol style="list-style-type: none">1. Register as voter2. Search Poll by entering the poll name3. Vote4. View the voting progress and result5. Check vote by

4.4 System Performance Definition

The targeted improvement of this system is the security and confidentiality of the system. Therefore, every time a user enters, there will be a minimum validation method to verify that the user has complete input and that the input format is correct. These validation methods can be found in the tool provided in ASP.NET. In order to further enhance the security of the one-step system, the department will also use Captcha and OTP (One Time Password) to authenticate users. In addition, the system will use SHA-256 to encrypt some sensitive personal data. And will use HTTPS and SSL (Secure Socket Layer) for encryption, in order to authenticate the visited websites, and protect the privacy and integrity of the data exchanged during transmission.

4.5 Verification Plan

1. The correct format of the email typed by the user.

Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
<div>Admin Registration</div> <div><div>Username</div><div>edwin</div></div> <div><div>Password</div><div>•••••</div></div> <div><div>Retype-Password</div><div>•••••</div></div> <div><div>Name</div><div>Chin</div></div> <div><div>IC Number (12 digit)</div><div>112211221122</div></div> <div><div>Email</div><div>edwinchin@x</div><div>Invalid E-mail Address Format!</div></div> <div><div>Register</div><div>Reset</div></div>				
All Content Copyright © of E-Voting System Sdn Bhd (3609-M) 2020. All Right Reserved				

Figure 4.5.1 The correct format of the email typed by the user

2. The input place provided to the user must be entered.

Home	About Us	Contact Us	Admin Login
<h3>Admin Login</h3> <div><div>Username</div><div><input type="text"/></div><div><i>Username is Blank!</i></div></div> <div><div>Password</div><div><input type="password"/></div><div><i>Password is Empty!</i></div></div> <div><div>Captcha</div><div><div>nhcdNn</div></div></div> <div><div>Retype-Captcha</div><div><input type="text"/></div><div><i>Please retype the captcha!</i></div></div> <div><div>Login</div></div>			
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Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
<h3>Admin Registration</h3> <div><div>Username</div><div><input type="text"/></div><div><i>Username is Empty!</i></div></div> <div><div>Password</div><div><input type="password"/></div><div><i>Password is Empty!</i></div></div> <div><div>Retype-Password</div><div><input type="password"/></div><div><i>Retype-Password is Empty!</i></div></div> <div><div>Name</div><div><input type="text"/></div><div><i>Name is Empty!</i></div></div> <div><div>IC Number (12 digit)</div><div><input type="text"/></div><div><i>IC Number is Empty!</i></div></div> <div><div>Email</div><div><input type="text"/></div><div><i>Email is Empty!</i></div></div> <div><div>Register</div><div>Reset</div></div>				
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Figure 4.5.2 The input place provided to the user must be entered.

- The IC number entered by the user must be 12 Integer.

Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
<div>Admin Registration</div> <div><div>Username</div><div>edwin</div></div> <div><div>Password</div><div>•••••</div></div> <div><div>Retype-Password</div><div>•••••</div></div> <div><div>Name</div><div>Chin</div></div> <div><div>IC Number (12 digit)</div><div>123456789 <i>Invalid IC Number!</i></div></div> <div><div>Email</div><div>edwinchin@yahoo.com</div></div> <div><div>Register</div><div>Reset</div></div>				
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Figure 4.5.3 The IC number entered by the user must be 12 Integer.

4. A username or IC Number cannot be repeatedly register as a new admin.

Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval												
<h3>Admin Registration</h3> <table><tr><td>Username</td><td><input type="text" value="edwin"/></td></tr><tr><td>Password</td><td><input type="password" value="....."/></td></tr><tr><td>Retype-Password</td><td><input type="password" value="....."/></td></tr><tr><td>Name</td><td><input type="text" value="Chin"/></td></tr><tr><td>IC Number (12 digit)</td><td><input type="text" value="960611085225"/></td></tr><tr><td>Email</td><td><input type="text" value="edwinchin@yahoo.com"/></td></tr></table> <div><input type="button" value="Register"/> <input type="button" value="Reset"/></div>					Username	<input type="text" value="edwin"/>	Password	<input type="password" value="....."/>	Retype-Password	<input type="password" value="....."/>	Name	<input type="text" value="Chin"/>	IC Number (12 digit)	<input type="text" value="960611085225"/>	Email	<input type="text" value="edwinchin@yahoo.com"/>
Username	<input type="text" value="edwin"/>															
Password	<input type="password" value="....."/>															
Retype-Password	<input type="password" value="....."/>															
Name	<input type="text" value="Chin"/>															
IC Number (12 digit)	<input type="text" value="960611085225"/>															
Email	<input type="text" value="edwinchin@yahoo.com"/>															
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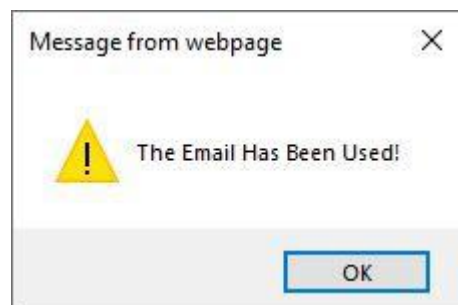
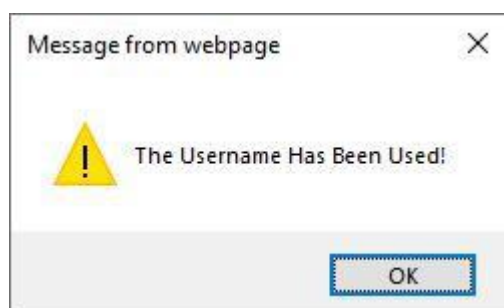


Figure 4.5.4 A username or IC Number cannot be repeatedly register as a new admin.

5. Password and Retyped Password must be matched for registration.



Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval												
<h3>Admin Registration</h3> <table><tr><td>Username</td><td><input type="text" value="edwin123"/></td></tr><tr><td>Password</td><td><input type="password" value="....."/></td></tr><tr><td>Retype-Password</td><td><input type="password" value="....."/> <i>Password Not Match!</i></td></tr><tr><td>Name</td><td><input type="text" value="Chin"/></td></tr><tr><td>IC Number (12 digit)</td><td><input type="text" value="960611085225"/></td></tr><tr><td>Email</td><td><input type="text" value="edwinchin@yahoo.com"/></td></tr></table> <div><input type="button" value="Register"/> <input type="button" value="Reset"/></div>					Username	<input type="text" value="edwin123"/>	Password	<input type="password" value="....."/>	Retype-Password	<input type="password" value="....."/> <i>Password Not Match!</i>	Name	<input type="text" value="Chin"/>	IC Number (12 digit)	<input type="text" value="960611085225"/>	Email	<input type="text" value="edwinchin@yahoo.com"/>
Username	<input type="text" value="edwin123"/>															
Password	<input type="password" value="....."/>															
Retype-Password	<input type="password" value="....."/> <i>Password Not Match!</i>															
Name	<input type="text" value="Chin"/>															
IC Number (12 digit)	<input type="text" value="960611085225"/>															
Email	<input type="text" value="edwinchin@yahoo.com"/>															
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Figure 4.5.5 Password and Retyped Password must be matched for registration.

6. An IC number cannot be repeatedly applied for or voted in the same poll.
Repeated Registered IC in the same poll: 11111111111

Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
------	--------------------	---------------	----------------	--------------------

Voter Approval

r_id	p_id	email	IC	real_time_record	role
42	8	edwinchin_96@yahoo.com			voter

12

r_id:

IC:

(#The administrator can type "000000000000" in the IC text box to reject the application without checking the database.)

r_id:42 Not Qualified

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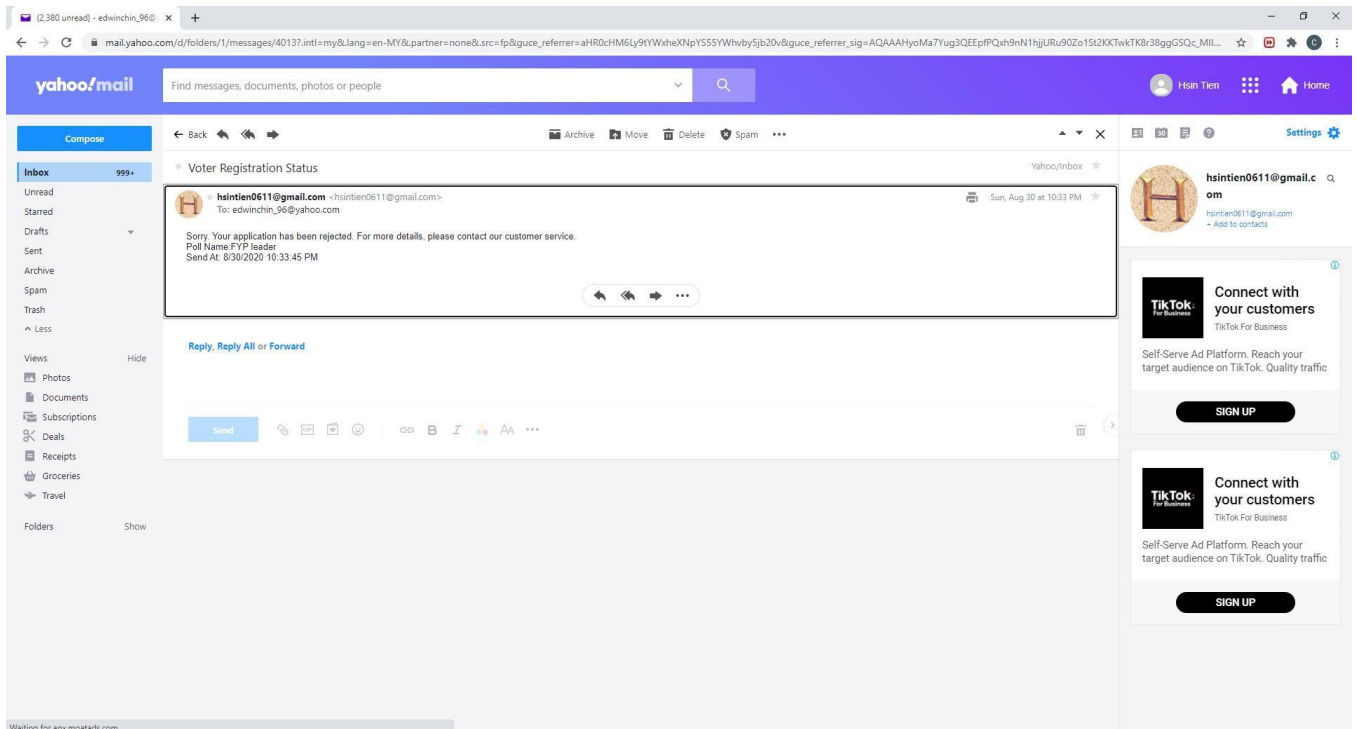


Figure 4.5.6 An IC number cannot be repeatedly applied for or voted in the same poll

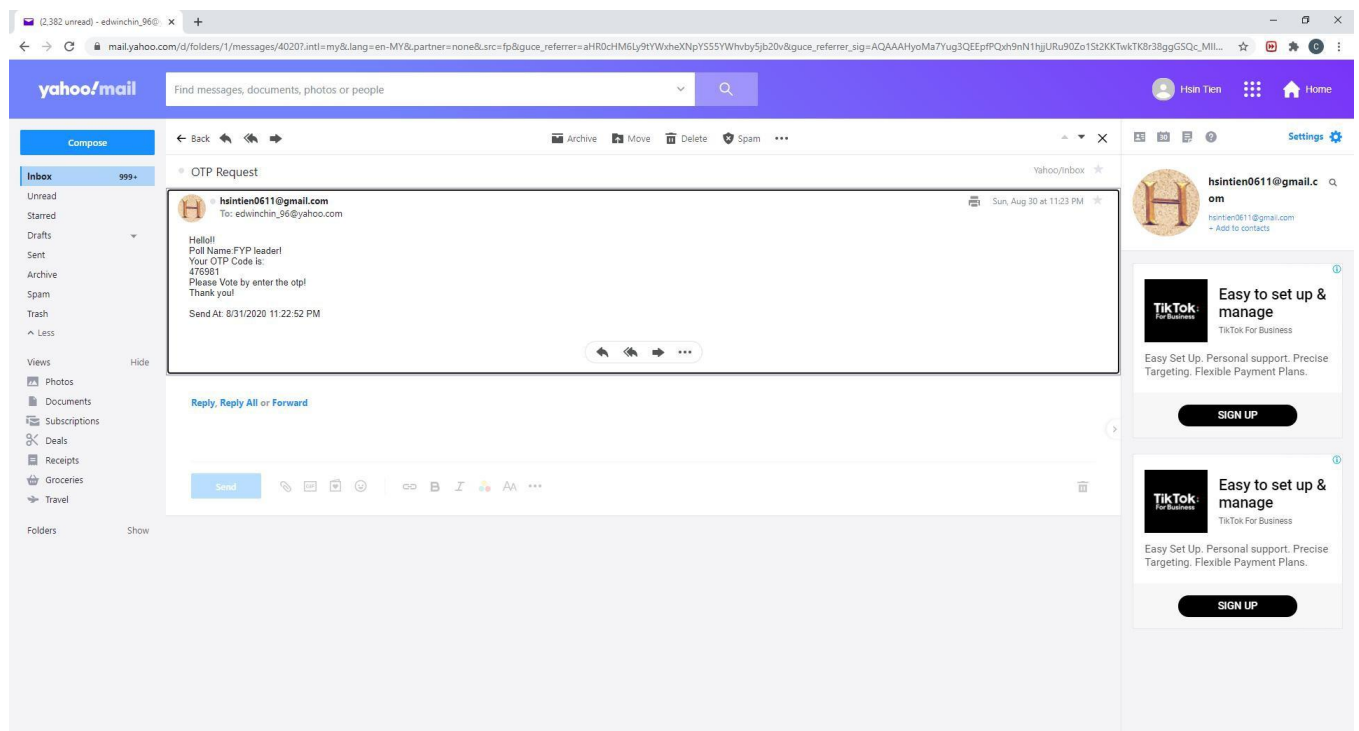
7. Retype captcha and retype password must be correct.

The screenshot displays the 'Admin Login' page of an application. At the top, there is a blue navigation bar with links for 'Home', 'About Us', 'Contact Us', and 'Admin Login'. The main content area is titled 'Admin Login' and contains a login form. The form includes fields for 'Username' (containing 'edwin'), 'Password', 'Captcha' (displaying 'z8ue7ocQ'), and 'Retype-Captcha'. Below the 'Retype-Captcha' field, a red error message states 'Your Retyped Captcha is wrong!!'. A 'Login' button is positioned at the bottom of the form. The footer of the page is a blue bar with the text 'All Content Copyright © of E-Voting System Sdn Bhd (3609-M) 2020. All Right Reserved'.

Home	About Us	Contact Us	Admin Login
<h3>Admin Login</h3> <p>Username: <input type="text" value="edwin"/></p> <p>Password: <input type="password"/></p> <p>Captcha: <input type="text" value="z8ue7ocQ"/></p> <p>Retype-Captcha: <input type="text"/></p> <p><i>Your Retyped Captcha is wrong!!</i></p> <p><input type="button" value="Login"/></p>			
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Figure 4.5.7 Retype captcha and retype password must be correct.

8. The entered OTP for voting must be the same as the OTP sent to the user for verification.



Home	About Us	Contact Us	Admin Login
<p>Poll Name: FYP leader Vote to: Chin Hsin Tien</p> <p>IC : <input type="text" value="556655665566"/></p> <p><input type="button" value="Get OTP"/></p> <p>Email sent</p> <p>OTP: <input type="text" value="334433"/></p> <p><input type="button" value="Vote"/> <input type="button" value="Reset"/></p> <p>All Content Copyright © of E-Voting System Sdn Bhd (3609-M) 2020. All Right Reserved</p>			



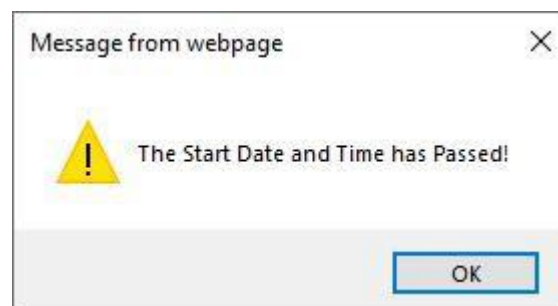
Figure 4.5.8 The entered OTP for voting must be the same as the OTP sent to the user for verification.

9. Start Date and End Date Must Be Valid when creating a new poll.

Date when Testing: 8/30/2020

Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
<h3>Poll Creation</h3> <div><div>Poll Name</div><div>FYP leader</div><div>Description</div><div>Please Vote me</div><div>Start Date</div><div>08/10/2020</div><div>Start Time</div><div>04</div><div>00</div><div>End Date</div><div>08/19/2020</div><div>End Time</div><div>08</div><div>00</div><div>Create</div><div>Reset</div></div>				

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Home	Admin Registration	Poll Creation	Voter Approval	Candidate Approval
<h3>Poll Creation</h3> <p>Poll Name <input type="text" value="FYP leader"/></p> <p>Description <input type="text" value="Please Vote me"/></p> <p>Start Date <input type="text" value="08/31/2020"/> </p> <p>Start Time <input type="text" value="04"/> <input type="text" value="00"/></p> <p>End Date <input type="text" value="08/19/2020"/> </p> <p>End Time <input type="text" value="08"/> <input type="text" value="00"/></p> <p><input type="button" value="Create"/> <input type="button" value="Reset"/></p>				
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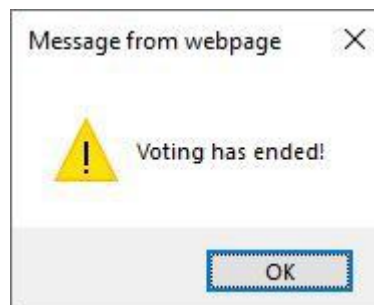
Figure 4.5.9 Start Date and End Date Must Be Valid when creating a new poll.

10. Date Must be valid when performing “Vote”, “Register as Voter” and “Register as Candidate”

Vote: Before the end of the voting period



Register as Voter: Before the end of the voting period



Register as Candidate: Before the voting starts

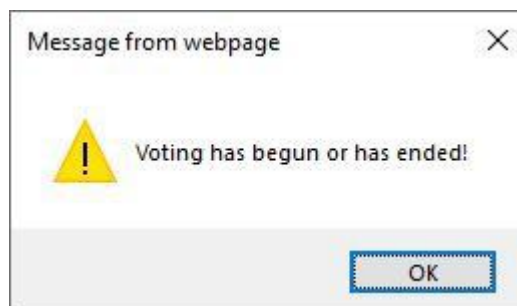


Figure 4.5.10 Date Must be valid when performing “Vote”, “Register as Voter” and “Register as Candidate”

11. Voters cannot vote repeatedly
IC of voters who have voted: 231321323232

Home	About Us	Contact Us	Admin Login
------	----------	------------	-------------

Poll Name: FYP leader
Vote to: Chin Hsin Tien

IC :

OTP:

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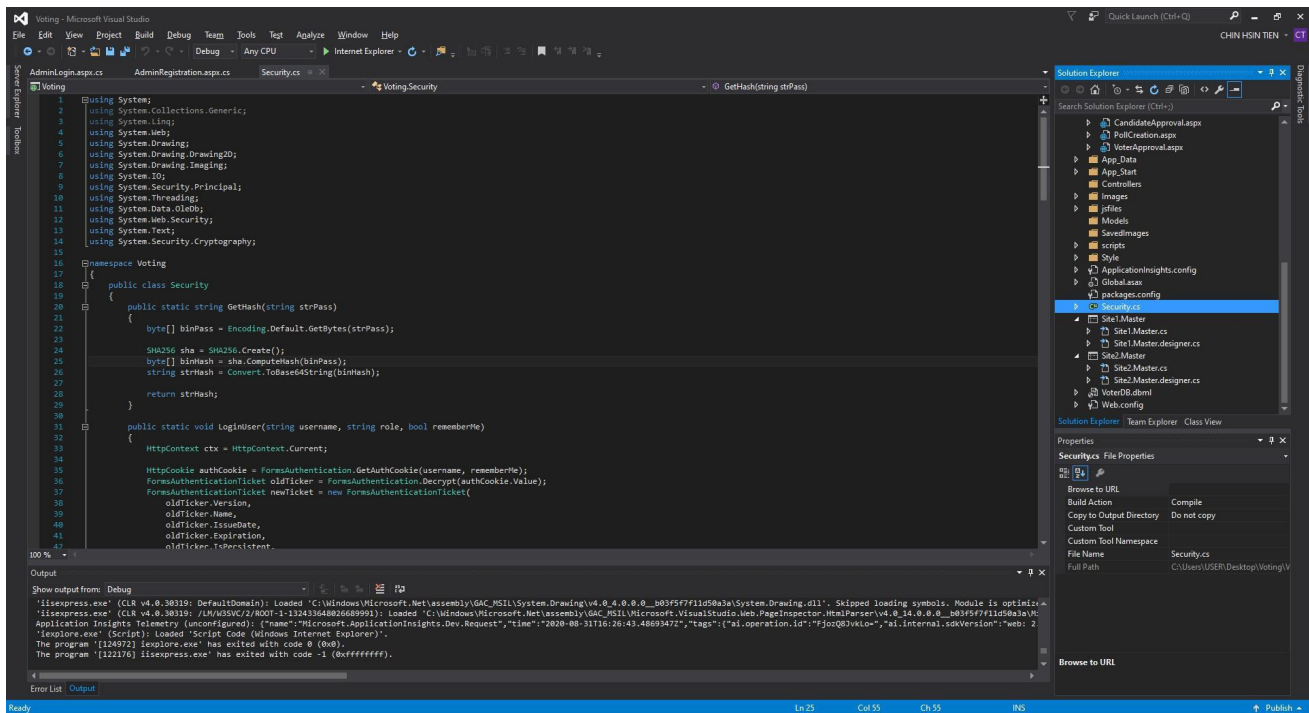
Figure 4.5.11 Voters cannot vote repeatedly

Chapter 5: Implementation of Cryptography Technology

5.1 Hashing function for sensitive data:

Hashing function SHA-256 is apply to sensitive data such as voter's IC number, candidate's IC number and admin password.

1) Open a class file call security.cs



2) Import all the classes that used for cryptography

```
using System;
using System.Web;
using System.IO;
using System.Security.Principal;
using System.Threading;
using System.Data.OleDb;
using System.Web.Security;
using System.Text;
using System.Security.Cryptography;
```


3) Implement GetHashCode Function

```
public static string GetHashCode(string strPass)
{
    byte[] binPass = Encoding.Default.GetBytes(strPass);

    SHA256 sha = SHA256.Create();
    byte[] binHash = sha.ComputeHash(binPass);
    string strHash = Convert.ToBase64String(binHash);

    return strHash;
}
```

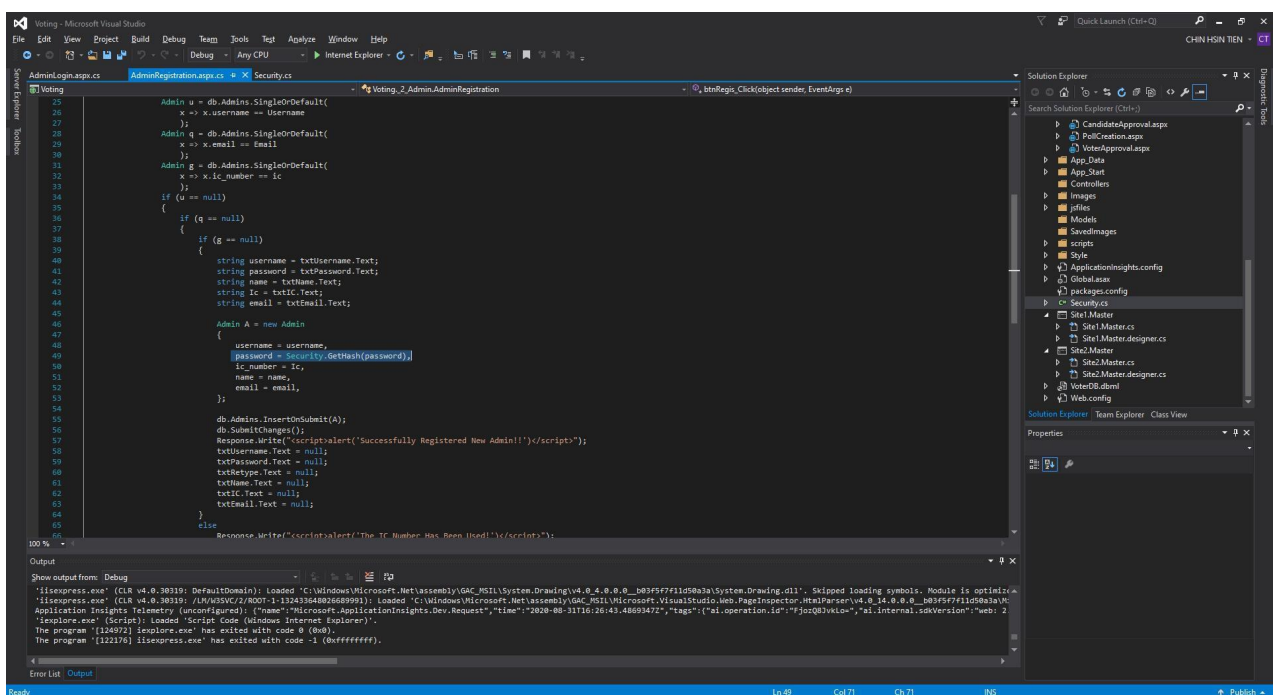
4) Implement LoginUser Function

```
public static void LoginUser(string username, string role, bool rememberMe)
{
    HttpContext ctx = HttpContext.Current;

    HttpCookie authCookie = FormsAuthentication.GetAuthCookie(username, rememberMe);
    FormsAuthenticationTicket oldTicket = FormsAuthentication.Decrypt(authCookie.Value);
    FormsAuthenticationTicket newTicket = new FormsAuthenticationTicket(
        oldTicket.Version,
        oldTicket.Name,
        oldTicket.IssueDate,
        oldTicket.Expiration,
        oldTicket.IsPersistent,
        role);
    authCookie.Value = FormsAuthentication.Encrypt(newTicket);
    ctx.Response.Cookies.Add(authCookie);

    string redirectUrl = FormsAuthentication.GetRedirectUrl(username, rememberMe);
    ctx.Response.Redirect(redirectUrl);
}
```

5) Example of Hashing



6) Example of Login User with Hashed Password

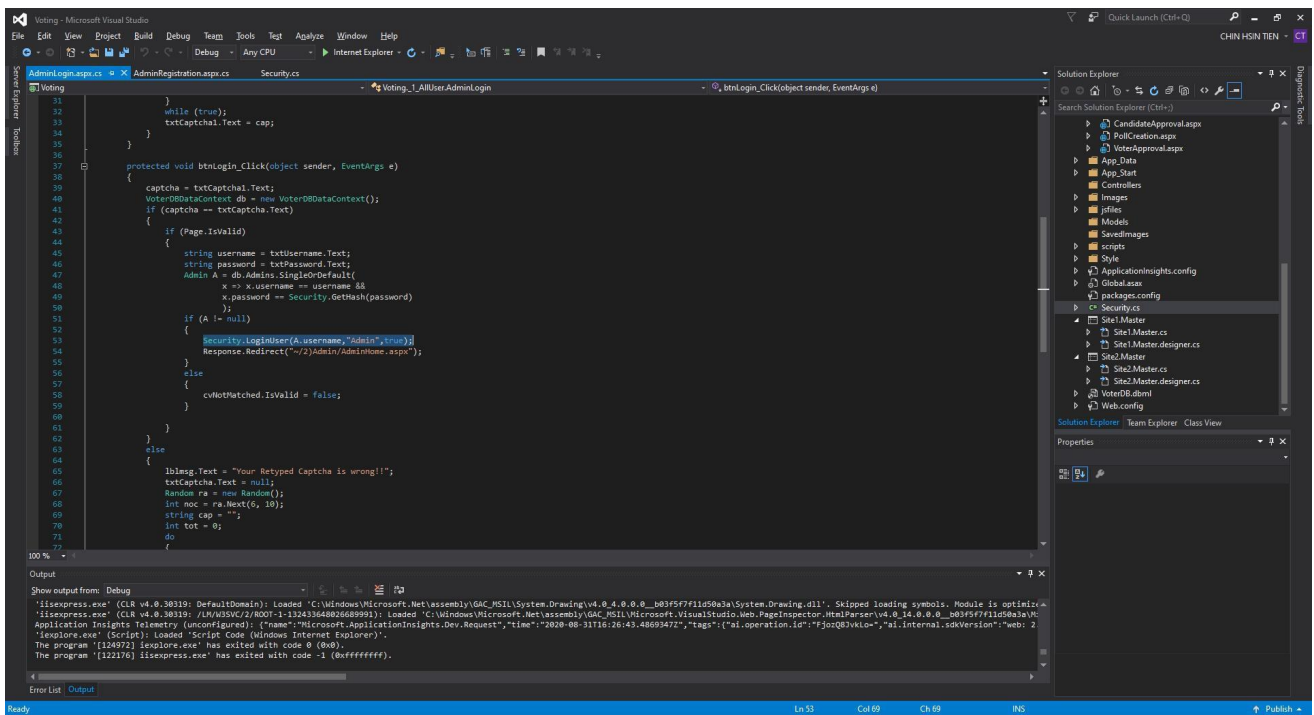
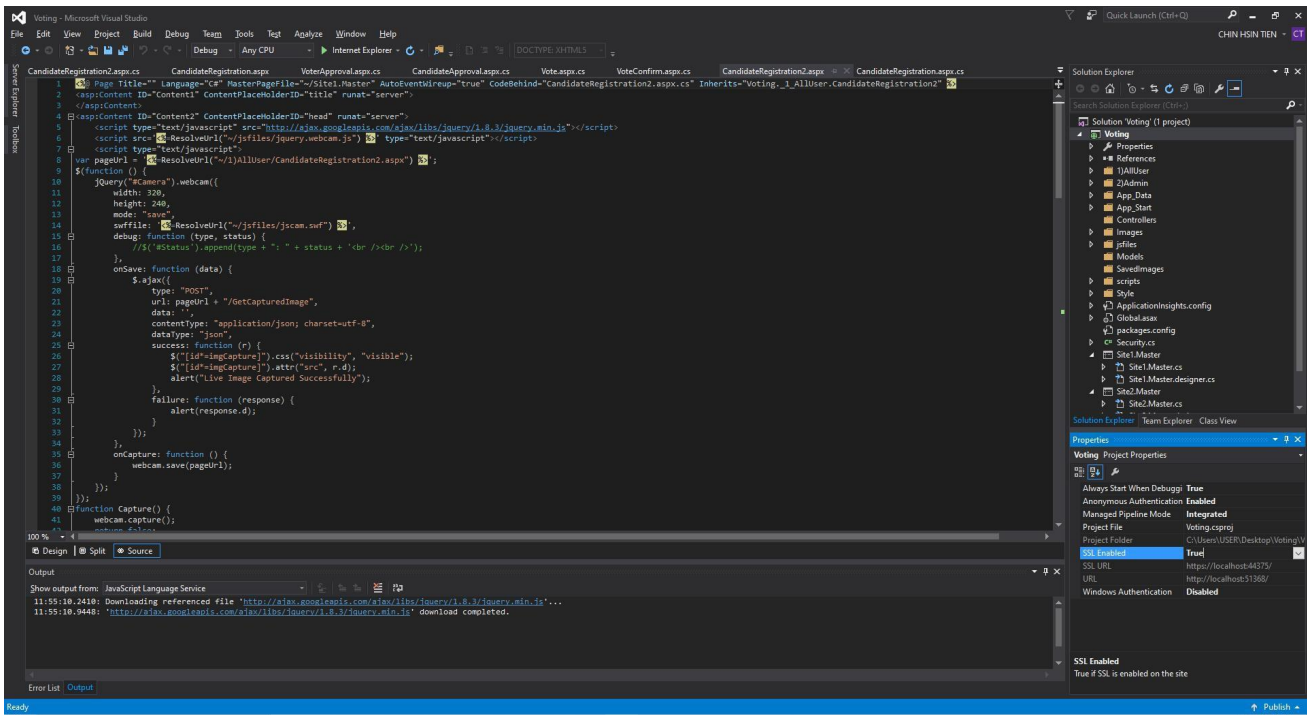


Figure 5.1 Hashing function for sensitive data

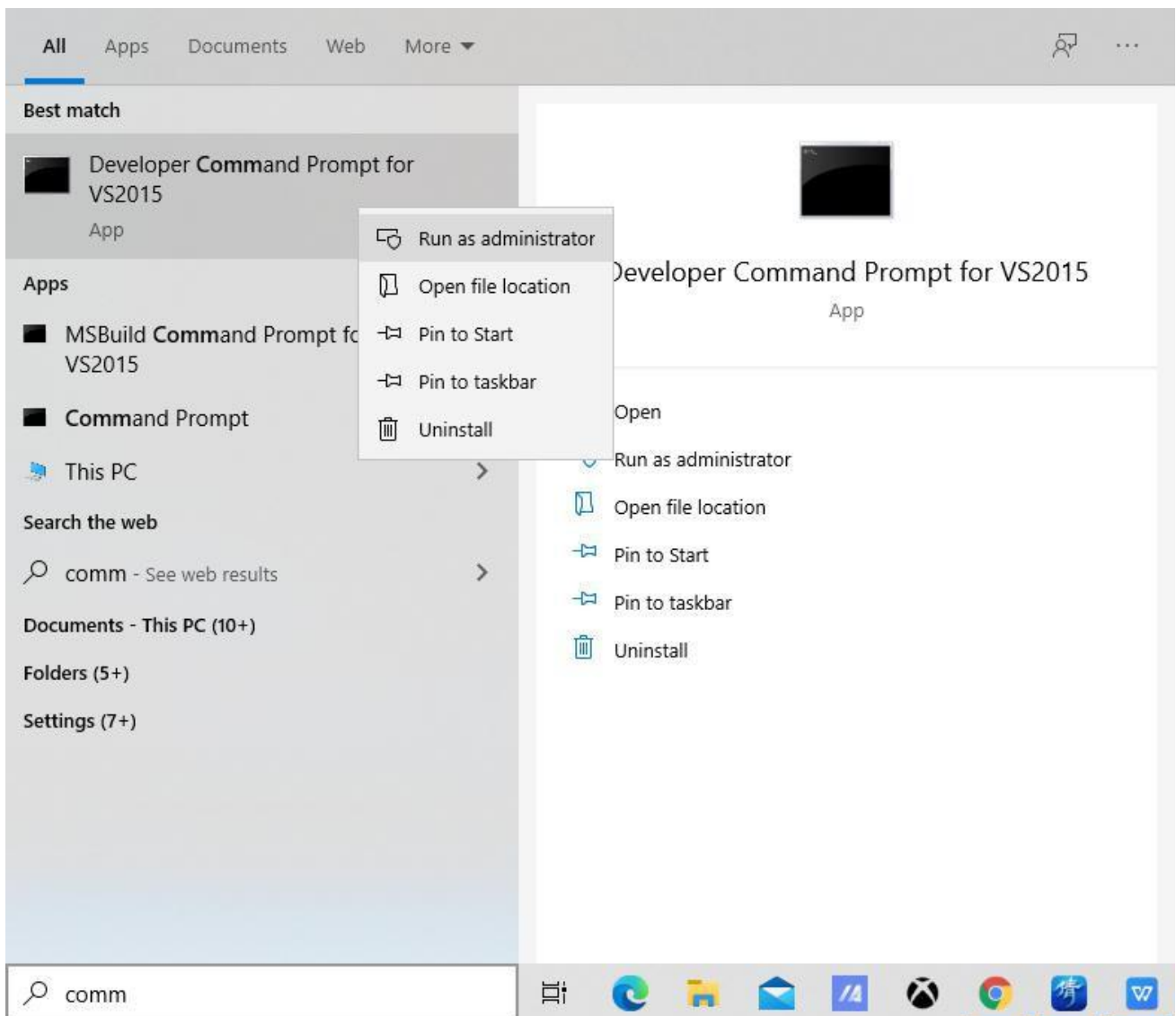
5.2 Apply SSL certificate for HTTPS:

Apply SSL certificate and allow the web application to browse by using HTTPS.

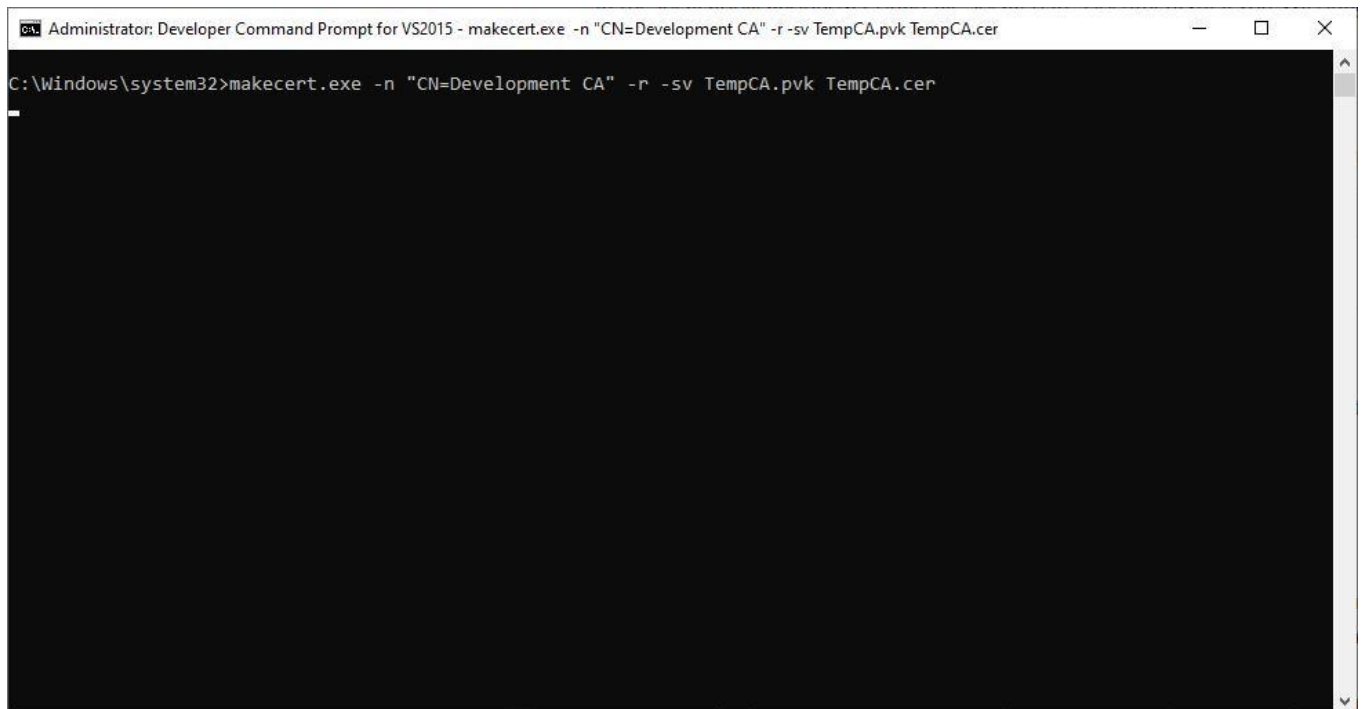
1) SSL Enabled set to true



2) Open Visual Studio Command Prompt as administrator



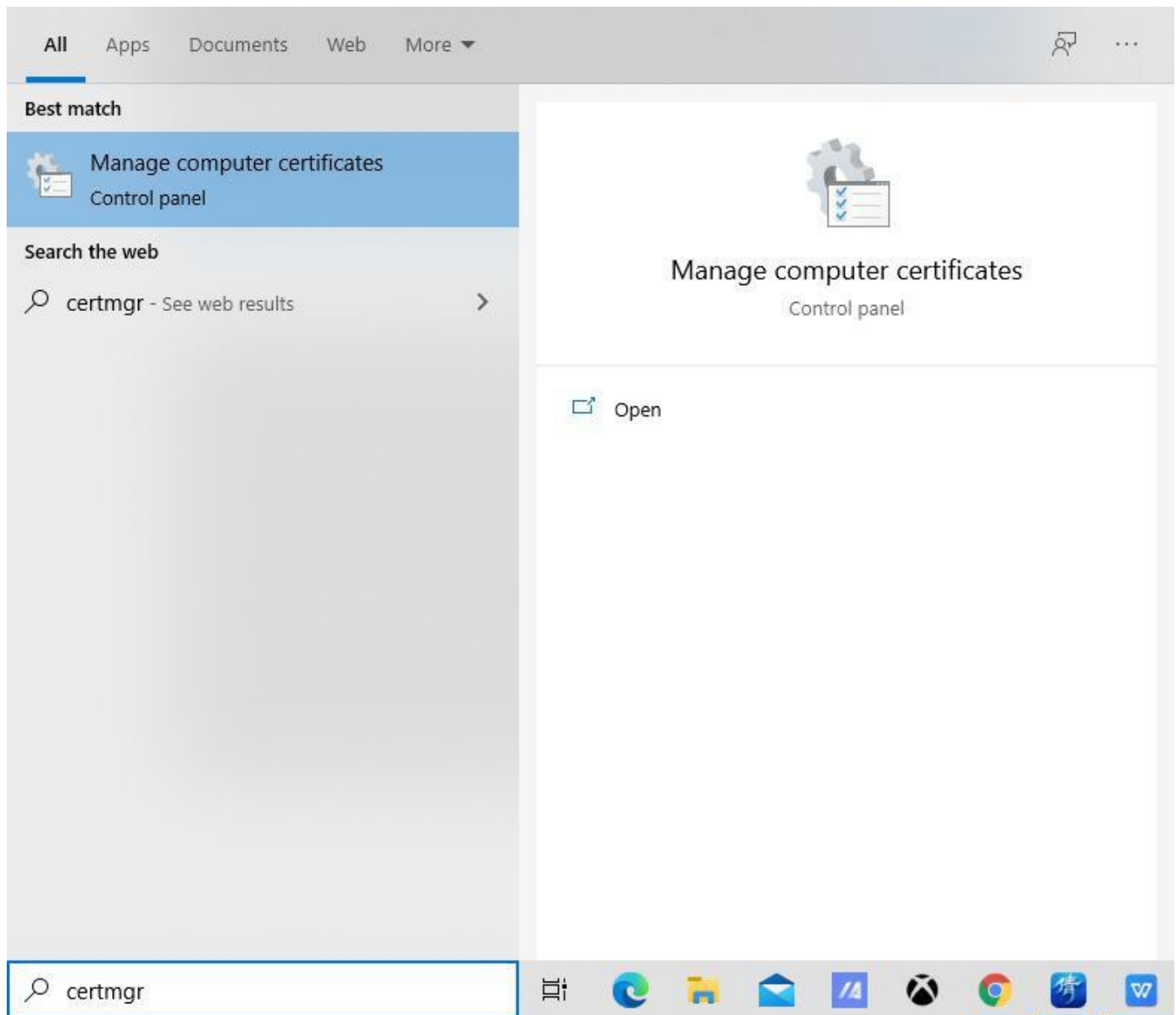
3) Create a self-signed certificate: makecert.exe -n "CN=Development CA" -r -sv TempCA.pvk TempCA.cer



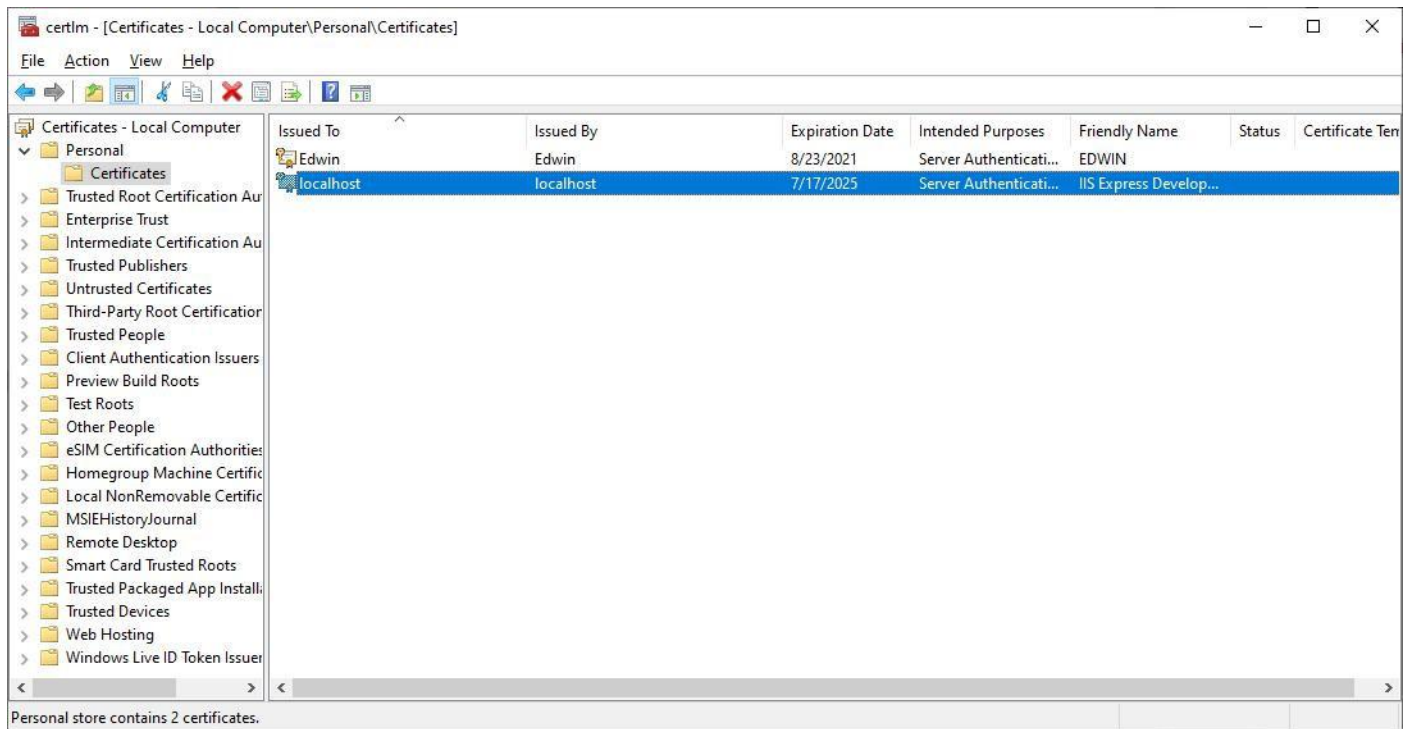
4) Set up password



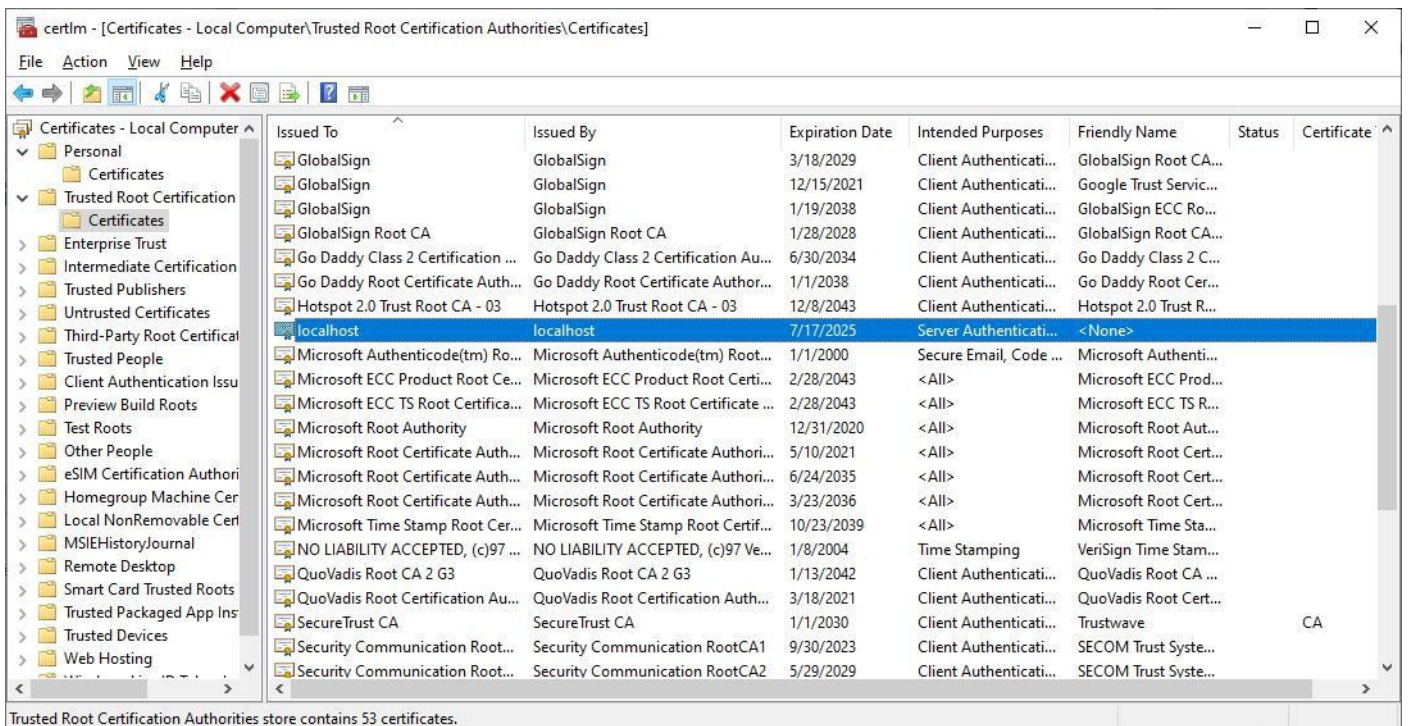
5) Click Start > Open certmgr



6) Export the certificate from : Personal > Certificate



7) Import the certificate to : Trusted Root Certification Authorities > Certificate



8) Open The Website by HTTPS

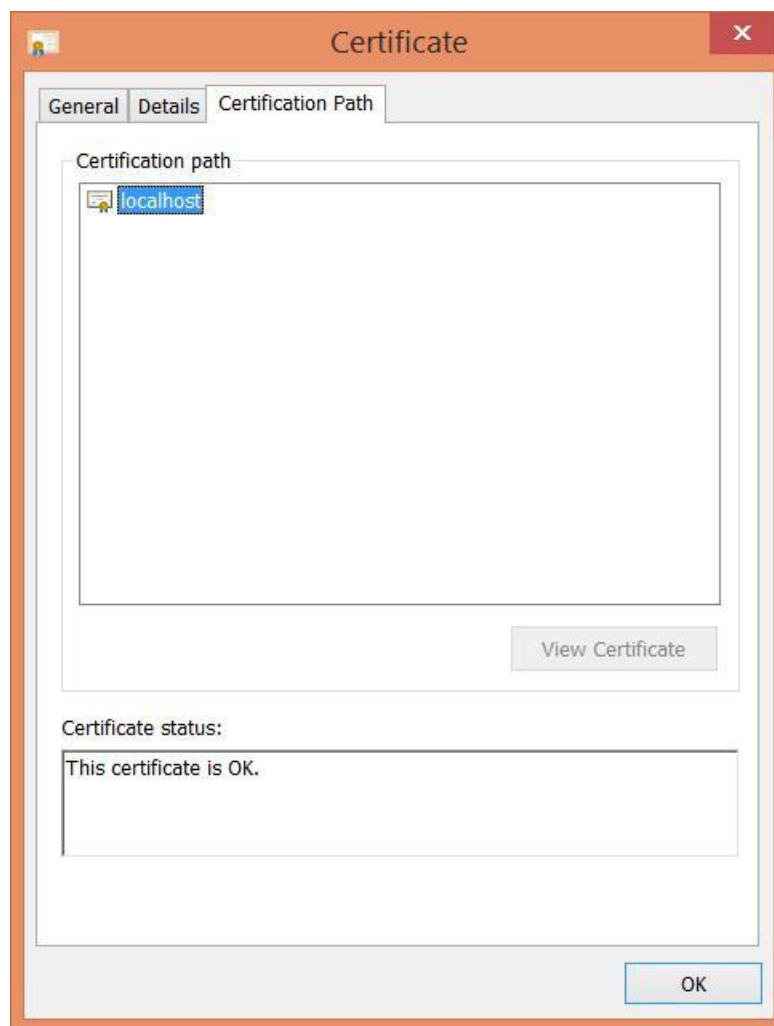
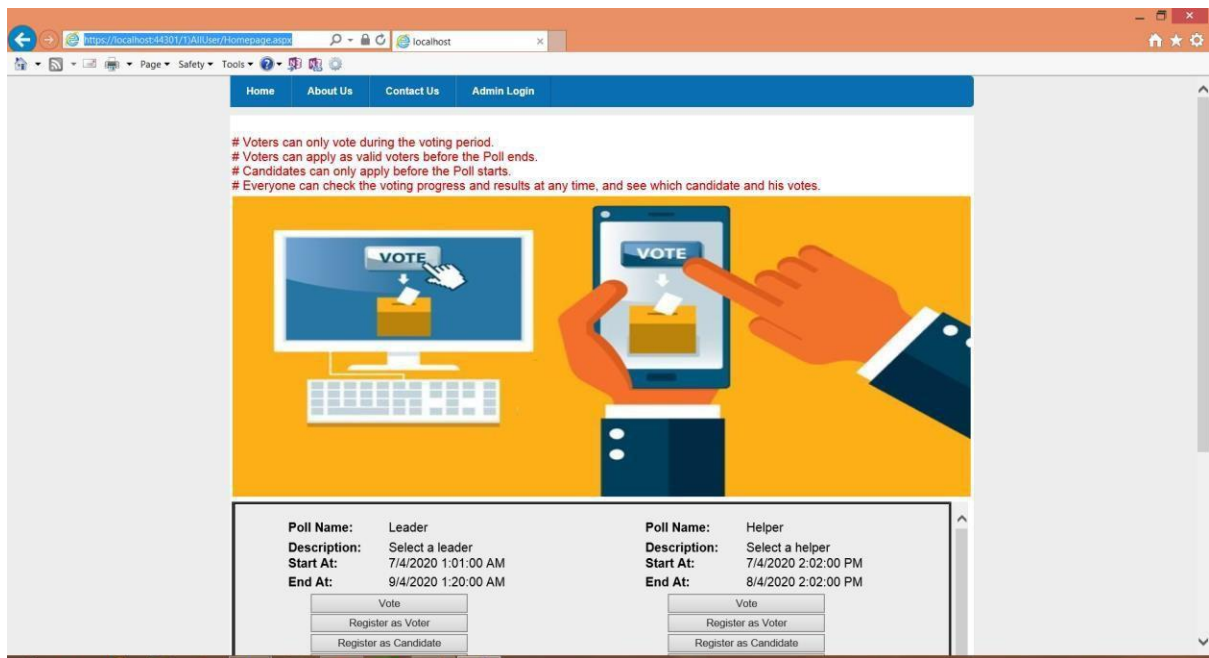


Figure 5.2 Apply SSL certificate for HTTPS

Chapter 6: Conclusion

In conclusion, although the electronic voting system has many advantages, the system has some risks. First of all, the most worrying is the safety and fairness of the system. Because the system needs to be carried out through the network, there are certain network risks and the fairness in the voting process cannot be guaranteed. In addition, hackers will also be the biggest enemy of the sub-system. Another problem is the dependence of modern people on technology, which leads to the fact that many things around us are technologically advanced, including voting systems. Therefore, young people are very indifferent to the traditional paper voting system. In addition, the system must also consider the user interface. If the interface is too complex and older voters are difficult to accept and use, it may cause users to be bored. Later, after the system is encrypted, people cannot know the contents, but the system can distinguish that we are the owner of the qualified voter account, and has a one-time voting right and the existing electronic voting has no anonymous function. This is also a challenge for the system to distinguish users with high security under anonymous conditions.

The motivation of this project is the practicality of the project. Due to the development of modern science and technology, our communication technology is also very developed and has accompanied us for a long time, so the networking of the voting system is also an important and must be performed process. In addition, electronic voting systems can change young people's attitudes towards the government and make it easier for people to participate in election campaigns in the country. Of course, the election is just an example. Our lives are full of moments that require voting decisions, so this may also allow people to participate more actively in voting activities. The second motivation of the project is to effectively increase user trust and system value by solving problems in existing electronic voting systems. This is also because the electronic voting system is a network program, and the security of the system is extremely important to protect the interests of users. If the use of a certain technology can improve the security and practicality of the electronic voting system, it will bring more benefits to people.

In order to complete an online voting system, we must select an Integrated Development Environment (IDE) that can be used to complete the system, and I will choose to use Visual Studio 2015 to complete this project. In this Visual Studio 2015, we will mainly prefer to use ASP.NET, C # (C-Sharp), JavaScript, Structured Query Language (SQL) and Cascading Style Sheets (CSS) to complete the interface and functions of various web pages.

Therefore, Visual Studio 2015 must install features such as ASP.Net, SQL database and further features to complete the minimum requirements for this project. After that, in order to improve the system security and confidentiality, the ASP.Net validation is used for the lower requirement for the system. Besides that, to further improve the security of the single-step system, the system also uses the verification code Re-Captcha and one-time password (OTP) to authenticate the user. After that, the system will use SHA-256 to encrypt some sensitive personal data and use HTTPS and SSL (secure proprietary layer) for encryption, in order to authenticate the visited websites, and protect the privacy and integrity of the data exchanged during transmission.


The implementing issues and challenges for this project is the security of the system, it is because the security of the system can greatly enhance the user's confidence in the use of the system. Therefore, in order to meet the system requirements of the goal, I have conducted a lot of research on this, and selected technologies and methods that can be implemented. The second challenge is the confidentiality of the system. This is mainly to ensure that users can have very good confidentiality when using this system, for example, users can check their own votes but others cannot query them. These methods require some time and effort to complete.

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Appendix


Poster- FYP 2



UTAR
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FACULTY OF INFORMATION COMMUNICATION AND TECHNOLOGY

An E-Voting Application Using
Cryptography Technology




Introduction

THIS ONLINE VOTING SYSTEM IS MAINLY TO PROVIDE AN ONLINE PLATFORM FOR VOTERS AND CANDIDATES TO VOTE THROUGH THE INTERNET OR SIGN UP TO PARTICIPATE IN VOTING PROJECTS

Objective

TO PROVIDE A HIGH SECURITY, USER FRIENDLY, CONVENIENT, FAIRNESS AND ANONYMOUS E-VOTING SYSTEM VIA THE INTERNET



Proposed Method

01


Hashing function for sensitive data:
Hashing function SHA-256 is apply to sensitive data such as voter's IC number, candidate's IC number and admin password.

02

Apply SSL certificate for HTTPS:
Apply SSL certificate and allow the web application to browse by using HTTPS.


Why the proposed system in this project is better than the existing system?

- 1)Better security measures - OTP,Captcha, Data verification
- 2)Faster and easier to use - User friendly, Webcam capture, Type less
- 3)Safer database- Encrypted data for sensitive information
- 4)Secure connection with the system- Using SSL certificate for HTTPS




Conclusion:

Cryptography is a technology to apply to this project to allowing authenticate the visited websites and protect the privacy and integrity of the data exchanged during transmission.



Project Developer: Chin Hsin Tien
Project Supervisor: Ts Dr Cheng Wai Khuen



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Chapter 1: Introduction
1.1 Problem Statement and Motivation

Although the E-Voting System has many advantages, there are some risk to the system. First and foremost, the most worrying is the security of the system. A simple and ordinary E- Voting System will have a lot of security issues, such as some of their personal data will be stolen by the hackers from this system through the network. In addition, the general voting system will have admin management, and they have very large powers including modifying the content of the system, so we can't ensure the fairness of the voting, which is the deadliest problems of e-voting so a method is needed to let users can also review the voting process but keep the votes secret. Besides that, as an E-Voting System, another biggest fatality is the hackers can steal someone else's account to vote, resulting in a ghost vote or account owner unable to vote effectively. Furthermore, another problem is the dependence of modern people on technology, which has led to the fact that many things around us have been technologically advanced, including voting system. Because of this, young people are very apathetic to traditional paper

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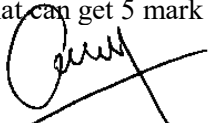
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