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I confirm that I understand my coursework needs to be submitted online via Google Classroom under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a mark of zero will be awarded.

Acknowledgement

I might want to express my most profound gratefulness to each one of those individuals who gave me the likelihood to finish the report. An appreciation to my mentors Ishwor Shrestha and Subekshya Shrestha, who have the major role to helped me to arrange my coursework particularly in report and Monil Adhikari a module leader.

An exceptionally extraordinary much gratitude goes to my school mates who helped me in settling this coursework inside constrained time spans. I might likewise want to express my exceptional thanks of appreciation to my college London metropolitan college which gave me the brilliant chance to do this superb coursework on the subject networking and working framework, which helped in doing bunches of research I came to know numerous things I am extremely grateful to them.

Abstract

In this coursework, we present the design and implementation of the online voting system. The online voting system gives voters a reliable and highly secure environment to cast their votes using internet terminals, such as PCs, mobile phones.

In this system the voter does not have to go to the polling booth to cast their vote. They can use their personal computer to cast their votes. There is a database which is maintained in which all the name of the voters with their complete information is stored. The System Administrator registers the voters by simply filling a registration form to register the voters. After registration they can vote to party and candidate.

The counting process is fully automated, giving no chance for manipulation of the results. When the results are ready, it will be posted on the result page along with statistics studies and graphics that explain the results.

Table of Contents

Table of Figures

Table of Tables

Chapter 1: Introduction

1.1 Introduction to the project

The 2000 presidential elections forced most of the organizations around the world to think of a better way of voting that enables as much people to cast their ballots in a convenient way. It was suggested to introduce a system that enables voters to use the internet is a cheap, fast, and effective way to transfer data. Many researchers have studied the benefits and threats of using internet for voting. Most studies raised concerns about voter's authentication, security of ballots during transfer through internet, and maintaining the secret ballot, which means to separate the identify of the voter from the ballot.

Online voting is a not a new concept. In the last three decades, studies tried to come up with a way to create online voting systems that enable peoples to vote while they are at their homes. It was not until the late 90's when the idea became practically possible. Internet revolution helped the idea to grow. Studies expect that online voting will replace the present voting systems sooner or later. (Elleithy et al., 2005)

In today's context, there are numbers of people living in abroad. They cannot participate in voting. They cannot choose and vote the party they like. Since, with the help of online voting system, people from abroad also can vote and express their view. Inside the country also, people from villages are living in Kathmandu valley. They have not return to their village to cast a vote. Many political issues are also there in voting area. Sometimes, the voting box keep missing and exchange with another voting box. Hence the online voting system is very useful in Nepal. Online Voting is a web-based voting system that will help you manage your elections easily and securely.

1.2 Aims and Objectives

The main aim of this project is to develop online voting system. The objectives are as follows:

- To reduce the human effort and saving time.
- To increase the voting accuracy.
- To reduce the threat for the people that can arise in voting area.
- The advantage of online voting is that the voters have the choice of voting at specific allocated time.
- It also minimizes vote counting error.
- People living in abroad also can cast a vote through online voting system.
- Online voting provides convenience, cost-saving, and saves the voters dealing with heavy traffic, and bad weather condition.
- It helps millions of disabled and blind people to cast their votes without any assistance.

1.3 Report Structure

Chapter 2: Background/ Literature Review:

In this topic, the background of the project is described such as languages, framework and application that will be used in project. Furthermore, this topic will include the similar website of this project. Similarities and Dissimilarities will be discussed in this topic.

Chapter 3: Development to Date:

In this topic, the detail development of this project is discussed which is up to date. Such as use case, ERD and wireframes are discussed.

Chapter 4: Analysis of progress

In this topic, the progress of the project is analyzed. Does the project is heading with project plan or not by reviewing the Gannt chart.

Chapter 5: Future Work

In this topic, the future work or remaining tasks are discussed. The tasks that are progessing but not yet completed and the tasks that are yet to do is discussed in this topic such as the back end codes and testing part.

Chapter 2: Background/ Literature Review

2.1 Background – Software Requirement

PHP

PHP is known as the general-purpose programming language. It is used as a server-side scripting language that is mainly used for the development of web sites. The PHP frameworks also make web development easier. This framework helps in reusing the same code and there is no need to write the lengthy and complex code for the web applications. PHP frameworks are mainly open source and can be used easily. The advantage of using php are as follow:

- PHP is open source and free of cost, which helps us to install it quickly and readily available for use.
- PHP is mainly supported by all the operating systems like Windows, Unix, Linux etc. The PHP based developed web applications can be easily run on any platform.
- It helps in saving a lot of effort and cost.
- PHP is easily connected with the database and make the connection securely with databases. It has a built-in module that is used to connect to the database easily.
- PHP based web applications can be easily tested. PHP unit uses to perform the unit testing quickly and easily. It also helps the programmers to write test cases and perform the testing smoothly.

(EDUCBA, 2019)

Laravel

Laravel is an open-source PHP framework, which is robust and easy to understand. It follows a model-view-controller design pattern. Laravel reuses the existing components of different frameworks which helps in creating a web application. The web application thus designed is more structured and pragmatic.

The advantages of using Laravel are:

- Laravel has a pre-installed powerful and lightweight template engine, helping developers in making some extraordinary layouts with intensive content seeding. Laravel template offers various solid widgets with robust CSS and JS coding.
- Laravel is the framework that facilitates you at best by being the only provider having dynamic pre-installed libraries. These libraries include Object Oriented libraries that cannot be found in other PHP frameworks.
- Laravel also assist in generating URLs which becomes very helpful for building links in your templates. All Laravel corridors are effectively laden by the framework which is delineated in the app/Http/routes.php file.
- Generally, a developer needs to interact with the Laravel framework using a command line that develops and manages the Laravel project environment. Laravel provides an integrated command line tool called Artisan. This tool helps to create skeleton code and database architecture as well as their migrations. Database management becomes easier as a result.

(Khalid, 2019)

HTML

Hypertext markup language (HTML) is the major markup language used to display Web pages on the Internet. In other words, Web pages are composed of HTML, which is used to display text, images or other resources through a Web browser. (Technopedia, 2020)

CSS

CSS is the language for describing the presentation of Web pages, including colors, layout, and fonts. It allows one to adapt the presentation to different types of devices, such as large screens, small screens, or printers. CSS is independent of HTML and can be used with any XML-based markup language. The separation of HTML from CSS makes it easier to maintain sites, share style sheets across pages, and tailor pages to different environments. (W3C, 2020)

JavaScript

JavaScript (JS) is a scripting language, primarily used on the Web. It is used to enhance HTML pages and is commonly found embedded in HTML code. JavaScript is an interpreted language. Thus, it doesn't need to be compiled. JavaScript renders web pages in an interactive and dynamic fashion. This allowing the pages to react to events, exhibit special effects, accept variable text, validate data, create cookies, detect a user’s browser, etc. (Technopedia, 2020)

2.2 Literature Review

The Rijnland Internet Election System (RIES) is a system designed for voting in public elections over the internet. The Rijnland Internet Election System (RIES) processed around 90000 votes in public elections in the Netherlands in 2004 and 2006. Based on total votes processed in public elections, RIES is one of the largest internet voting systems worldwide. As an interesting feature, RIES offers cryptographic end to end verifiability. This enables the voter to use cryptography to verify that her or his vote was counted as cast. After some delay, the source code to RIES was published on June 24th, 2008. This paper describes the result of a few days of looking at the source code and documentation of a rather complex internet voting system. This study began when the source code of RIES was published. The first preliminary results of this study were available to the Dutch media and members of parliament four days later on June 28th. (Ryan & Schoenmakers, 2009)

Similar systems

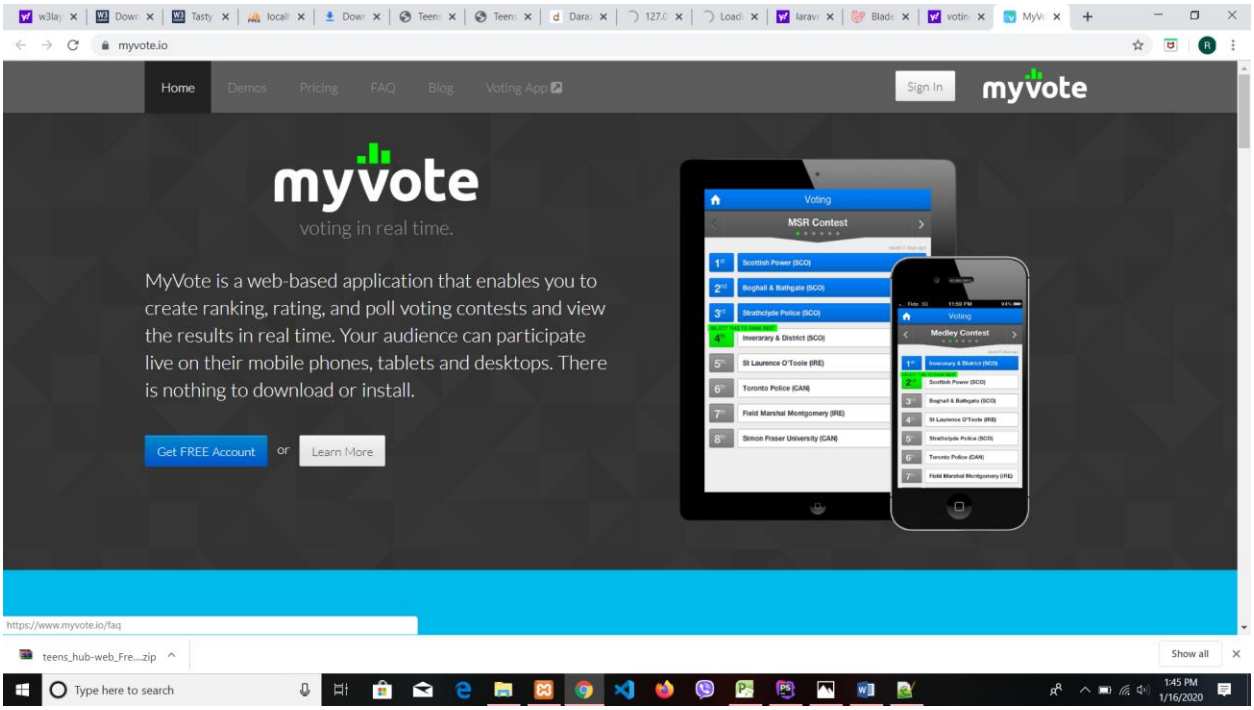


Figure 1: screenshot of similar voting app

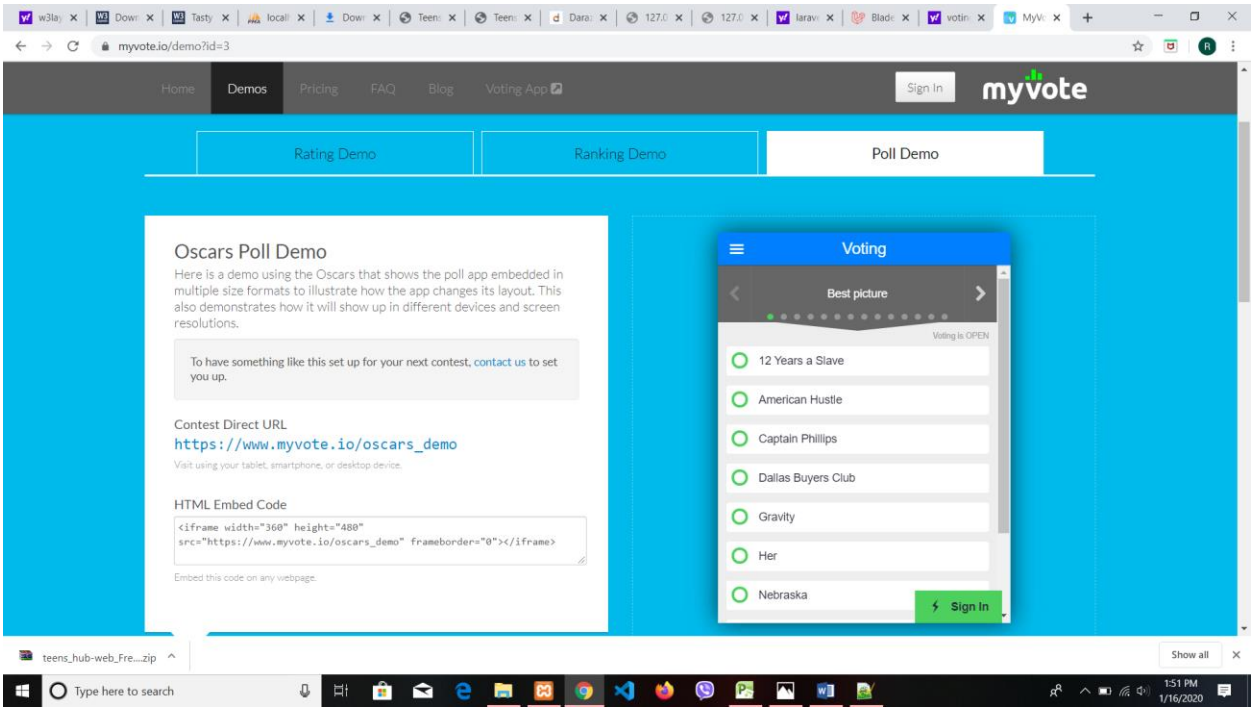


Figure 2: screenshot of polling page demo

Chapter 3: Development to Date

3.1 Methodology Considerations

Software development methodology is a framework that is used to structure, plan, and control the process of developing an information system. This kind of development methodologies are only concerned with the software development process, so it does not involve any technical aspect of, but only concern with proper planning for the software development. There are different project management methodologies such as waterfall model, Agile, Rational Unified Process (RUP) and many more. (TatvaSoft, 2020)

3.1.1 Waterfall Model

The waterfall model is one of the most traditional and commonly used software development methodologies for software development. This model clarifies the software development process in a linear sequential flow that means that any phase in the development process begins only if the earlier phase is completed. This development approach does not define the process to go back to the previous phase to handle changes in requirements.

Advantages of Waterfall Model:

- Waterfall model is very simple and easy to understand and use a method that is why it is beneficial for the beginner or novice developer
- It is easy to manage, because of the rigidity of the model. Moreover, each phase has specific deliverables and individual review process
- In this model phases are processed and completed are at once in a time thus it saves a significant amount of time

- This type of development model works more effectively in the smaller projects where requirements are very well understood.

Disadvantages of Waterfall Model:

- This model can only be used when very precise up-front requirements are available
- This model is not applicable for maintenance type of projects
- The main drawback of this method is that once an application is in the testing stage, it is not possible to go back and edit something
- There is no possibility to produce any working software until it reaches the last stage of the cycle
- This model is good for a small project but not ideally suitable for long and ongoing projects
- Not ideal for the projects where requirements are very moderates, and there is great scope for modification

(TatvaSoft, 2020)

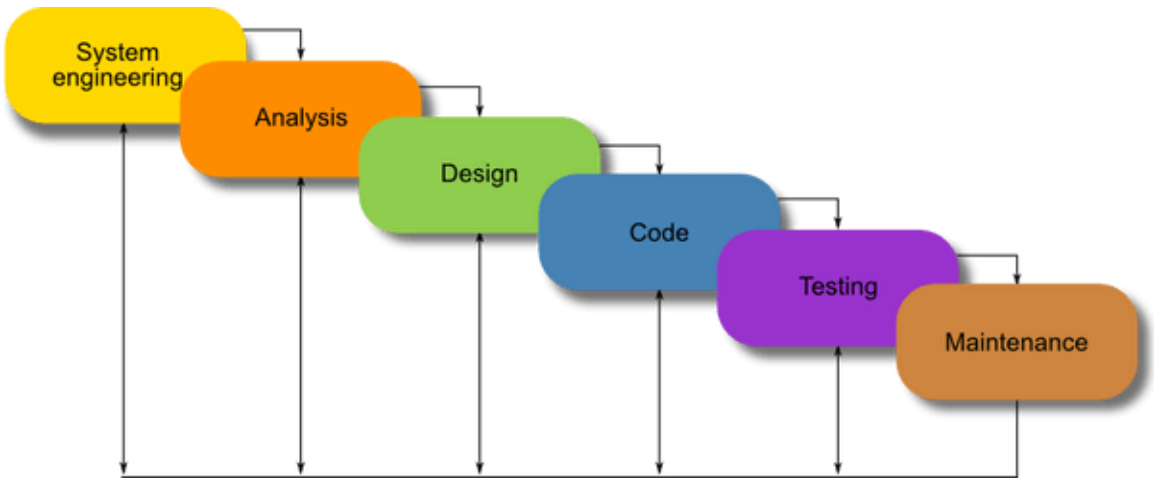


Figure 3: Waterfall model

In waterfall model, if we find an error or need to change something, we must essentially start the project from the beginning. This substantially increases the risk of project failure. But in this project, I may add some features later and it will be difficult to return in development phase when testing is already finished. That's why I didn't chose the waterfall model.

3.1.2 Agile Methodology

Agile Software Development is an approach that is used to design a disciplined software management process which also allows some frequent alteration in the development project. This is a type of software development methodologies which is one conceptual framework for undertaking various software engineering projects. The advantages and disadvantages are discussed below:

Advantages of Agile Development Methodology:

- Agile methodology has an adaptive approach which can respond to the changing requirements of the clients
- Direct communication and constant feedback from customer representative leave no space for any guesswork in the system

Disadvantages of Agile Development Methodology:

- This methodology focuses on working software rather than documentation; hence it may result in a lack of documentation.
- The software development project can get off track if the customer is not very clear about the final outcome of his project.

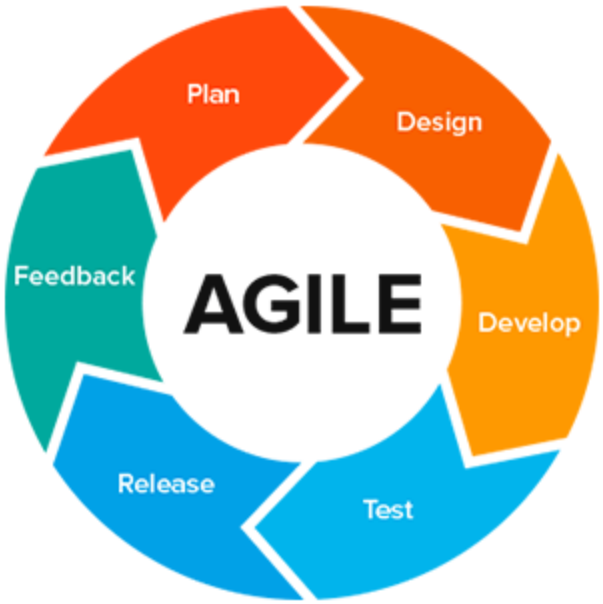


Figure 4: Agile Methodology

In Agile methodology, it is difficult to accurately determine the amount of time and money that will be needed to complete the project due to constantly changing requirements. But in this project, I need to finish the task and submit in time and I need brief documentation.

3.1.3 RUP Methodology

In RUP methodology, the development process is divided into four distinct phases that each involves business modeling, analysis and design, implementation, testing, and deployment. This is an object-oriented and web-enabled program development methodology. This model also helps software developer for providing them guidelines, templates, and examples for all aspects and stages of software development. As my project is online voting system and based on website, I chose RUP methodology. Furthermore, more details are discussed in (Chapter 3.2 Chosen Methodology).

3.2 Chosen Methodology

Rational Unified Process methodology is shortly known as an RUP is a one modern software development process. This methodology divides the development process into four distinct phases that each involves business modeling, analysis and design, implementation, testing, and deployment. This is an object-oriented and web-enabled program development methodology. This model also helps software developer for providing them guidelines, templates, and examples for all aspects and stages of software development.

Advantages of RUP Software Development Methodology:

- This methodology emphasizes on accurate documentation
- It is proactively able to resolve the project risks that are associated with the clients evolving requirements for careful changes and request management
- Very less need for integration as the process of integration goes on throughout the development process

(TatvaSoft, 2020)

Based on UML, RUP organizes the development of software into four phases, each consisting of one or more executable iterations of the software at that stage of development. The four phases of RUP are as follows:

Inception

In this stage, the projects business case is stated, and the team decides if the project is worth doing or if it is even possible. It is important to the process to first formulate the scope of the project and determine what resources will be needed.

Elaboration

In this stage, the developers take a closer look at the project to determine its architecture foundation and to evaluate the architecture in relation to the project. This stage is important to the RUP because it is here that developers analyze the risks associated with changing the scope of the project or adding new technologies along the way.

Construction

In this stage, the development of the project is completed. The application design is finished, and the source code is written. It is in this stage that the software is tested to determine if the project has met its goal laid out in the inception phase.

Transition

In this stage, any fine-tuning is performed. Any final adjustments can be based on user feedback, usability or installation issues.

(Webopedia, 2020)

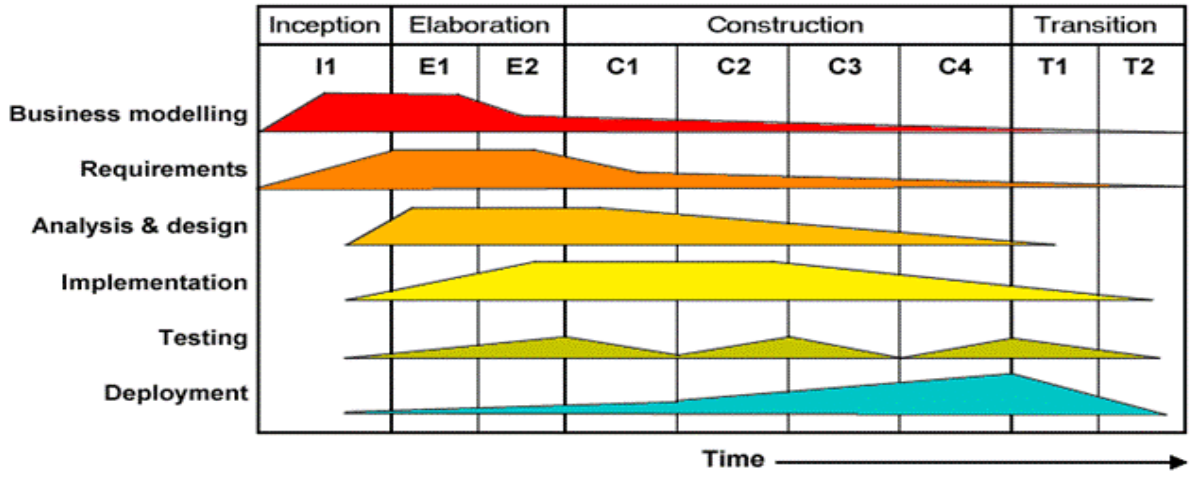


Figure 5: Rational Unified Process (RUP) Methodology

Description of project with RUP methodology in different phases.

Phases	Description
Inception	The topic was decided. The scope of this project (online voting system) was determine as main scope of this project is to eliminate manipulation of the votes and to make voting more accurate.
Elaboration	Analysis of the project and detail process or working method of the online voting system was done. Work process is separated based on timeline and Gannt chart is created which help in making strategies to complete the project in time.
Construction	In this phase, use case and ERDs is created, designing and coding of the website is done. Wireframes are design as per to meet the requirements of this project. With the help of wireframes, the website is developed by coding. Back end codes are also developed in this phase such as connecting database.
Transition	In this phase, the testing process is done. For examples, by clicking the result page, will it show results or not? Will the login account of the voters will store in database or not? Documentation of the project will be completed.

Table 1: Description of project with RUP methodology in different phases

3.3 Development Progress

On the stage, Inception, Elaboration phase and the wireframe designing part of construction phase is finished.

Screenshots of Use case, ERD and wireframes are as follows:

3.3.1 Use case of Online Voting system

Figure 6: Use case of online voting system

3.3.2 High Level Use Case

High Level Use Case for Register

Use case: Register

Actor: Voter, admin

Description: A new voters provides the details of his/ her information to the system.

High Level Use Case for Login

Use case: Login

Actor: Voter, admin

Description: After registration voter, login to the system.

High Level Use Case for Cast vote

Use case: Cast vote

Actor: Voter

Description: After login, voter cast a vote to different party and candidate.

High Level Use Case for Generate Result

Use case: Display Result

Actor: Admin

Description: To display the result after casting a vote.

High Level Use Case for Add Party

Use case: Add Party

Actor: Admin

Description: To add new party to the system as new party may be formed and take part in election.

High Level Use Case for Add Candidate

Use case: Add Candidate

Actor: Admin

Description: To add new candidate as many new candidates take part in election.

High Level Use Case for Delete Party

Use case: Delete Party

Actor: Admin

Description: To delete party that are no longer part of election as parties may separate into pieces.

High Level Use Case for Delete Candidate

Use case: Delete Candidate

Actor: Admin

Description: To delete candidate that are no longer part of election as many candidates left election.

3.3.3 Expanded Use Case Description

Expanded Use Case Description for Register

Name: Register

Actor: Voter

Purpose: A new member provides the details of his/ her information to the system in order to cast a vote.

Action Steps

Actor action	System Response
1. Voters will visit the website entering suitable URL.	
	2. System will display the website and display the login form that include username and password and in case voter doesn't have account, voter should register
3. Voters will click on register button.	
	4. System will display the registration from that include details of voters.
5. Voters will fill the form and click on submit button.	
	6. System will show the successful message.

Table 2: Expanded Use case of Register

Expanded Use Case Description for Login

Name: Login

Actor: Voter

Purpose: When user opens the browser then enters the respective URL of website then user login to the website by entering suitable username and password.

Action Steps

Actor action	System Response
1. User will visit the website entering suitable URL.	
	2. System will display the website and display the login form that include username and password.
3. User will input the username and password.	
	4. Find username and verify
	5. System will display the polling page.

Table 3: Expanded use case of login

3.3.4 ERD of online voting system

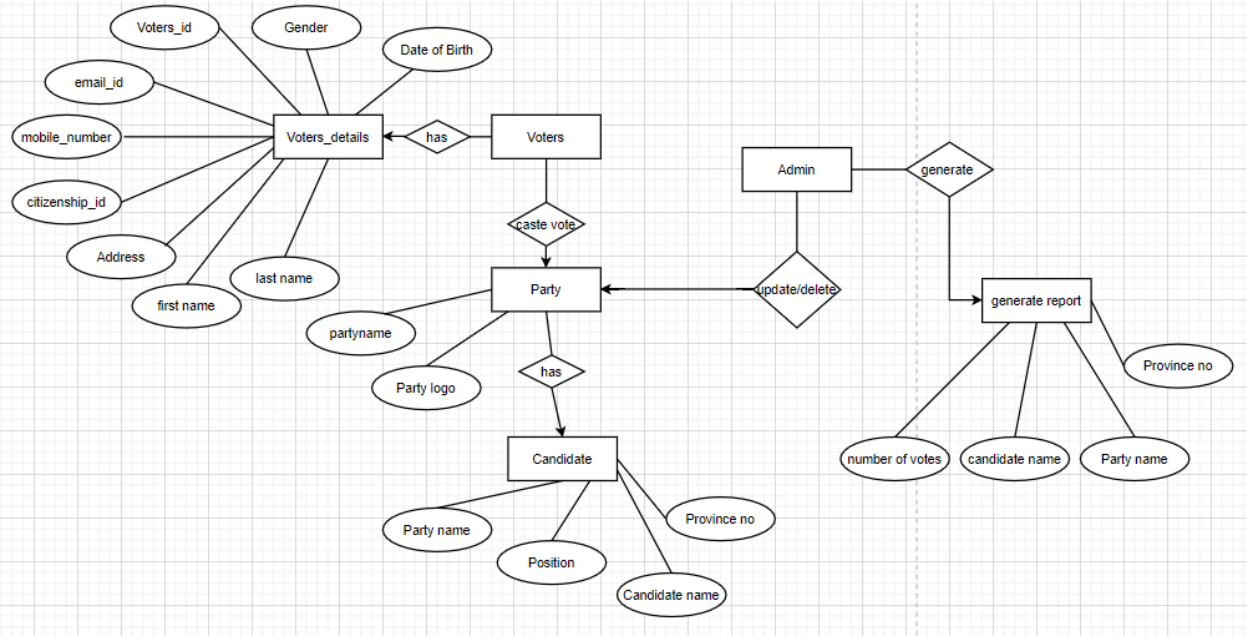


Figure 7: Conceptual ERD of online voting system

An entity relationship model, also called an entity-relationship (ER) diagram, is a graphical representation of entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems. An entity is a piece of data-an object or concept about which data is stored. (Beal, 2020)

The above diagram is the conceptual diagram of online voting system and the following diagram is the Entity Relational Diagram of online voting system. Here, there are 6 entities, they are Voters, Candidate, Party, Cast Vote, count vote and Generate Report. In Voters entity, the details of voters are recorded. In party entity, the detail of parties is displayed. In candidate entity, the details od candidate is displayed. In cast vote entity, the information of parties, voters and candidates are recorded to count the vote. In count vote entity, the information of parties, voters and candidates are recorded and count the vote. In Generate report entity, the result is displayed with number of votes alongside party and candidate.

The relation is also shown in the figure. As shown in figure, the relation between voters and candidate is many to one as many voters vote to a candidate. Similarly, relation between voters and party is many to one as many voters vote to a party. The relation between voters and cast vote entity is also many to one as numbers of voters are recorded. Similarly, relational between candidate and party with cast vote is also many to one.

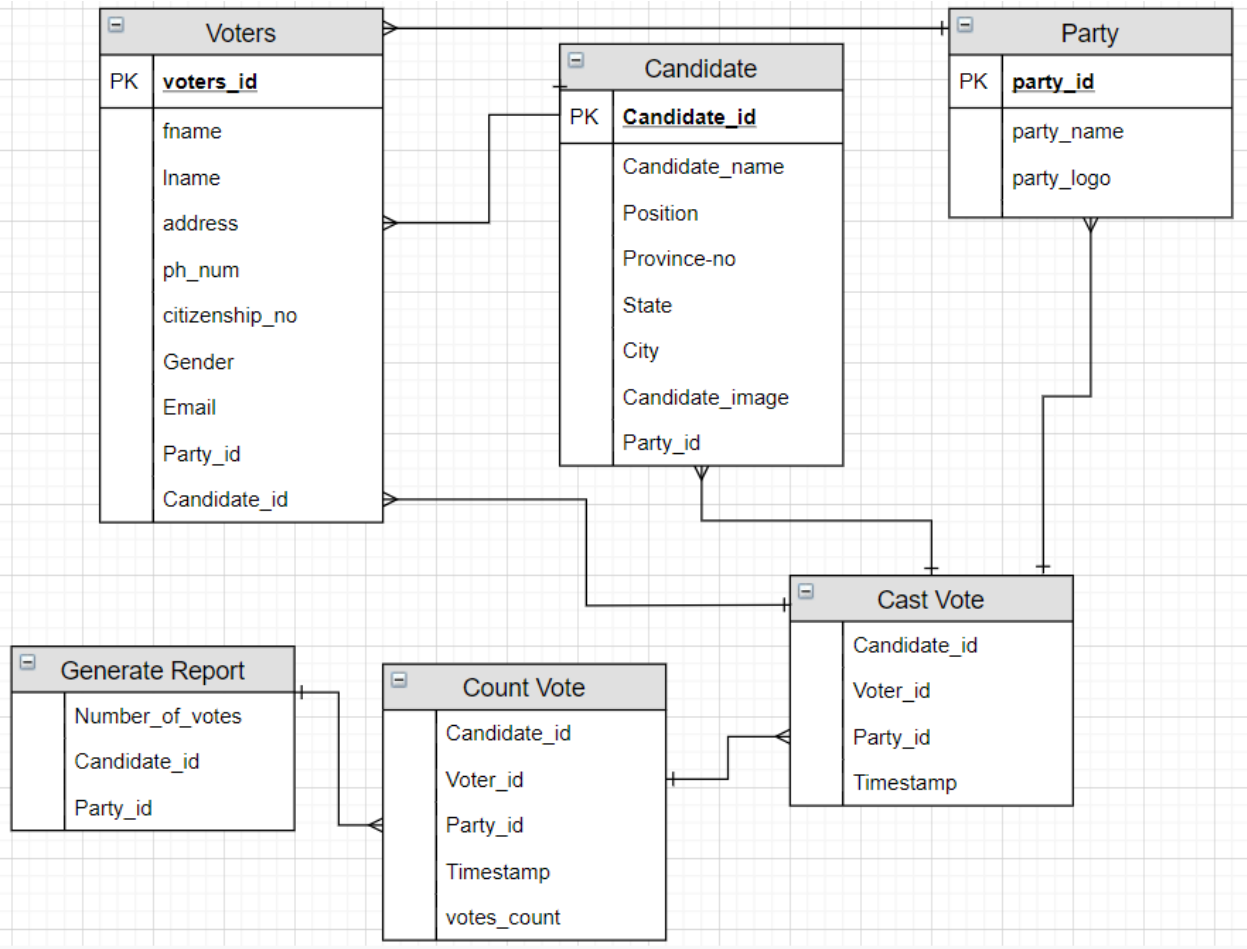


Figure 8: ERD of online voting system

3.3.5 Screenshots of Wireframes

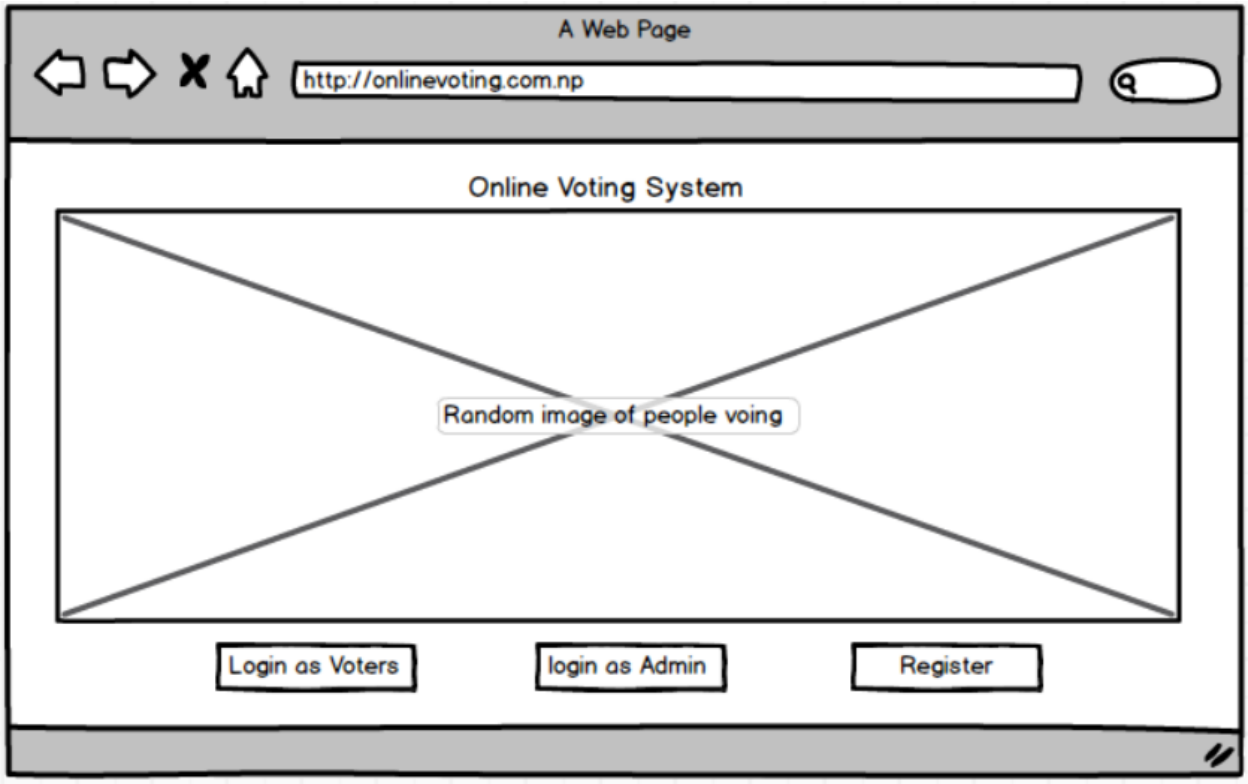


Figure 9: front page of online voting system

Here, the above picture is the screenshot of front page of online voting system. It has the login button for voters and admin separately. There is register button also for those who doesn't have an account. They cannot register for admin.

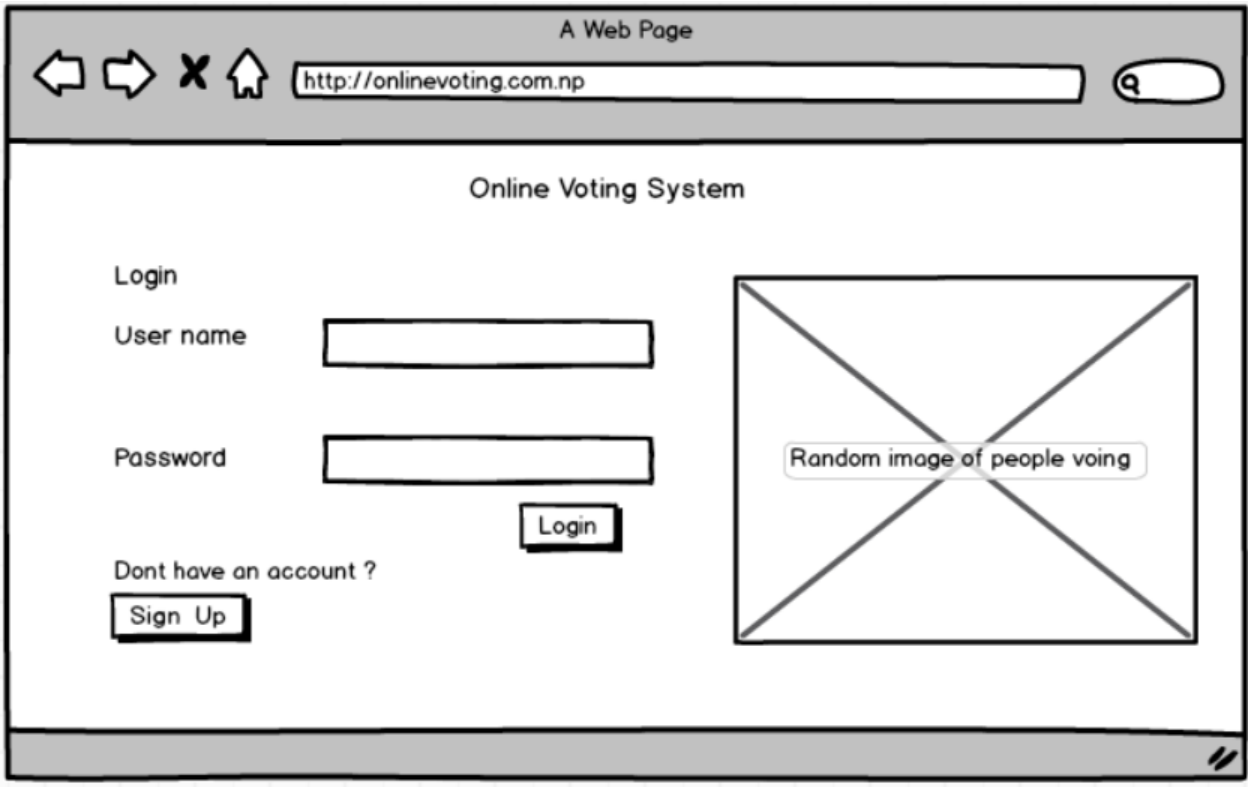


Figure 10: Login page for voters

Here, the above figure is the screenshot of login page for voters. This page content username and password to login. After clicking login button, voters successfully enter in polling page. There is also sign up button for those who doesn't have an account.

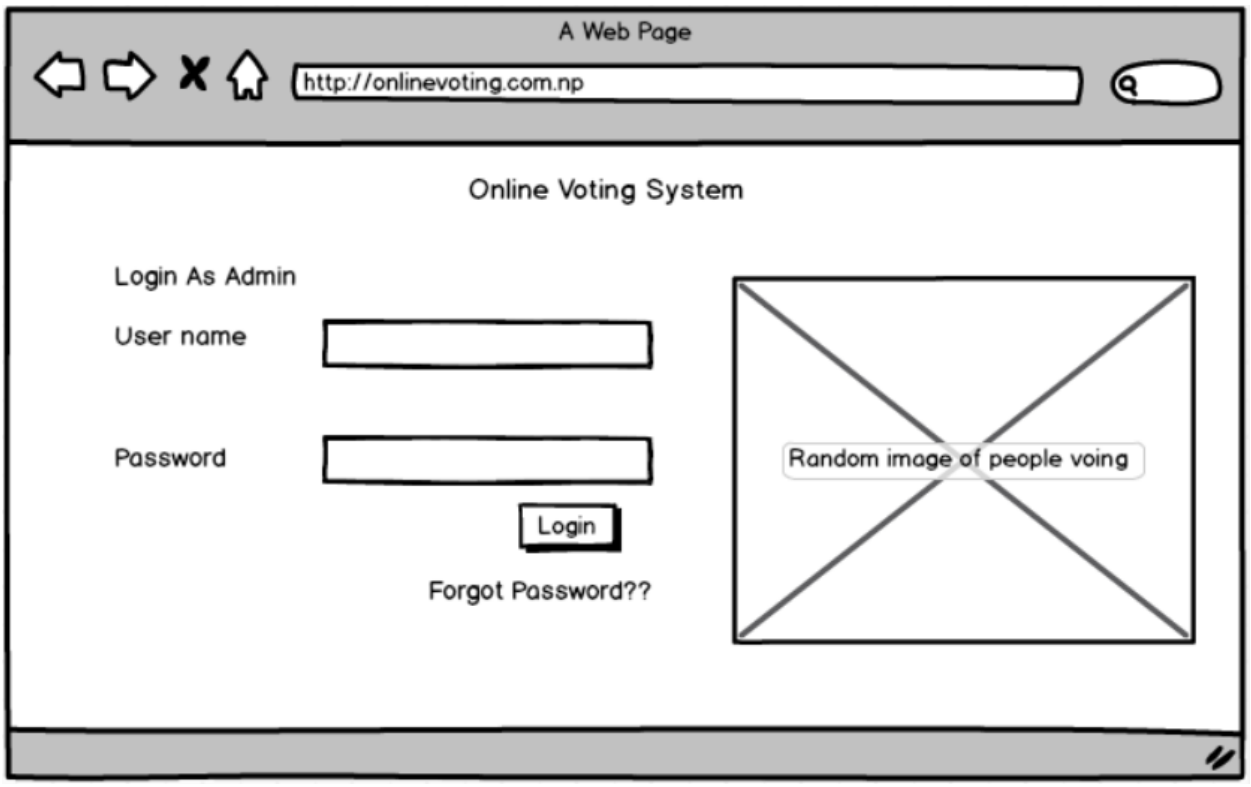


Figure 11: Login page for admin

Here the above figure is the login page for admin. Admin knows the username and password as he/she is the creator or developer of the system.

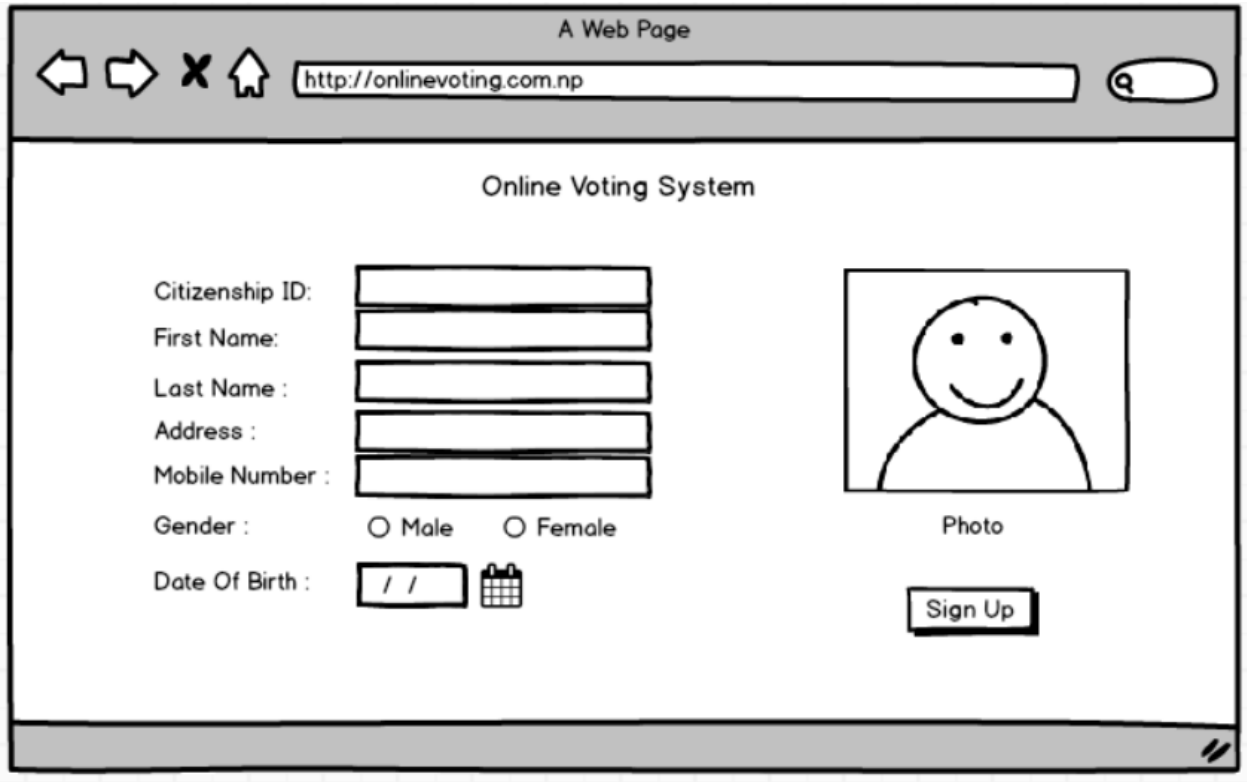


Figure 12: Registration form for voters

Here the above figure is of register page. Voters need to create account or register to cast a vote. Otherwise he/she cannot cast a vote. Voters need to fill the details information to cerate the account.

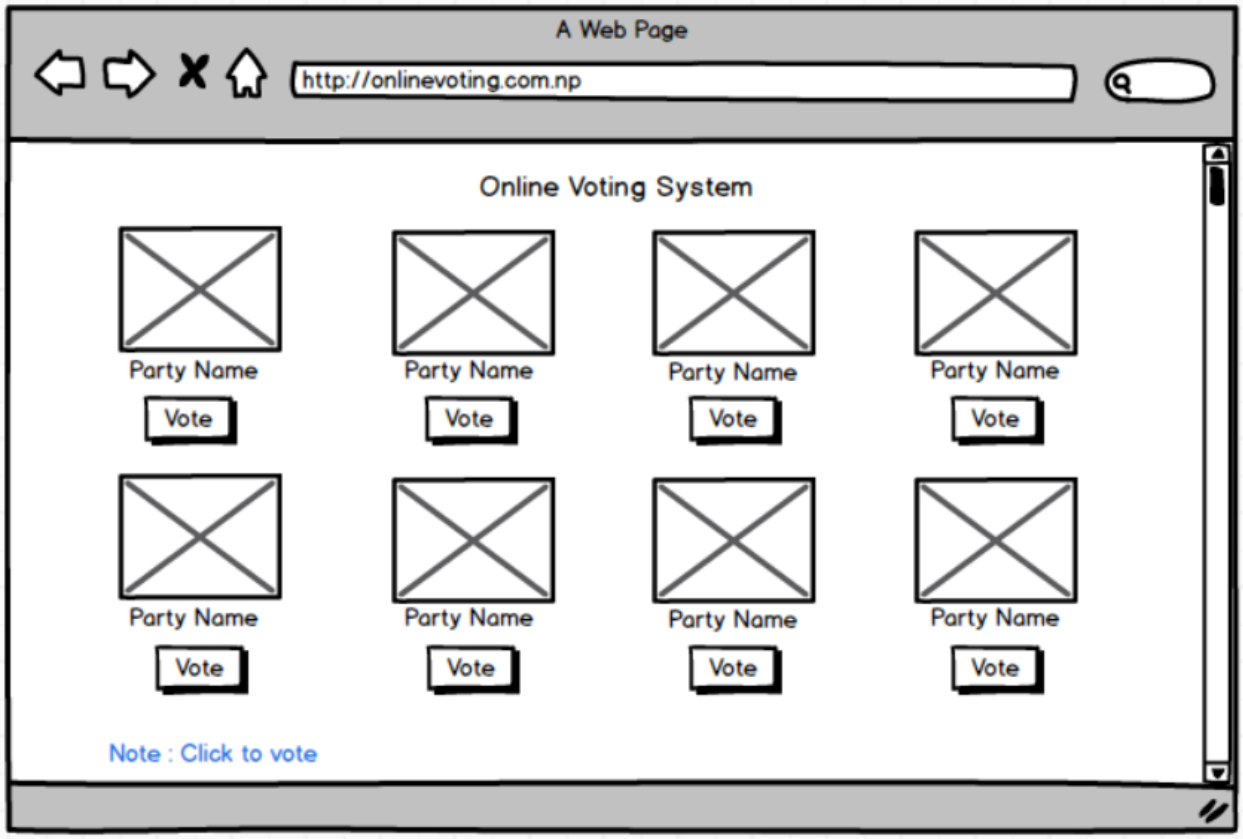


Figure 13: voting page of party

Here, the above figure is of polling page for party. After clicking login button, voters successfully enter in polling page. Here the party logo and party page are displayed. Voter can vote by clicking the vote button that are presented under party logo.

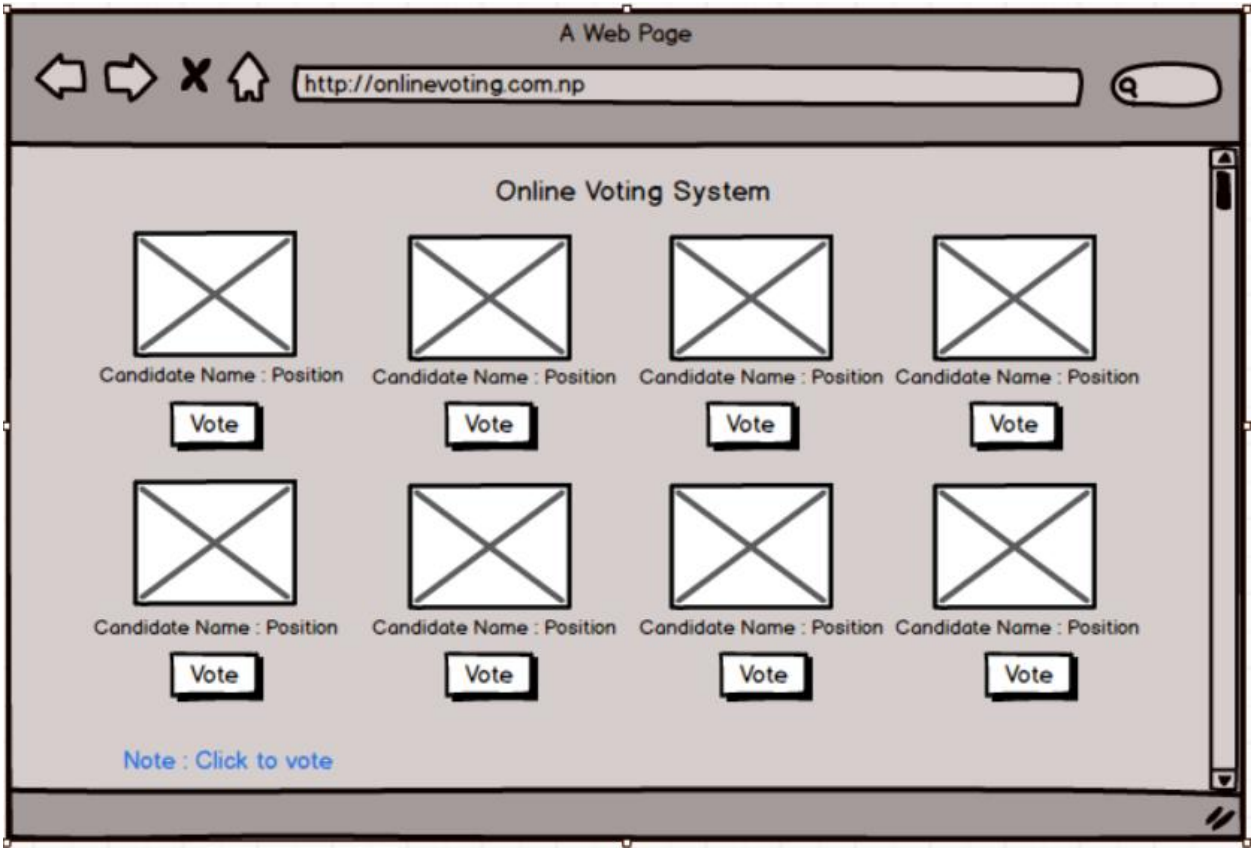


Figure 14: voting page of candidate

Here, the above figure is of polling page for candidate. After voting for party, voters successfully enter in polling page for candidate. Here the candidate photo and name are displayed. Voter can vote by clicking the vote button that are presented under candidate's picture.

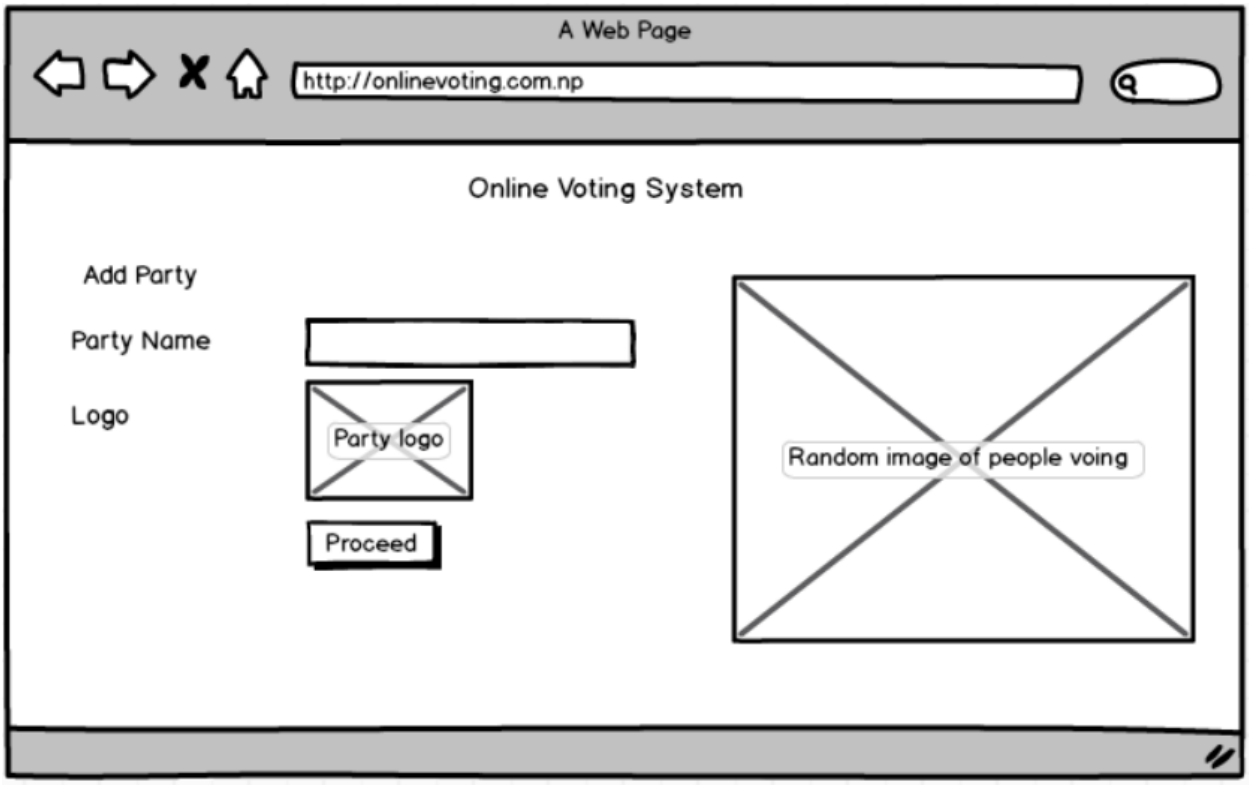


Figure 15: Adding new party

Here, the above picture is of add party page. It needs to fill the details of party such as party name and logo in order to add a party. By clicking the proceed button, admin can add the party by filling up the details of party.

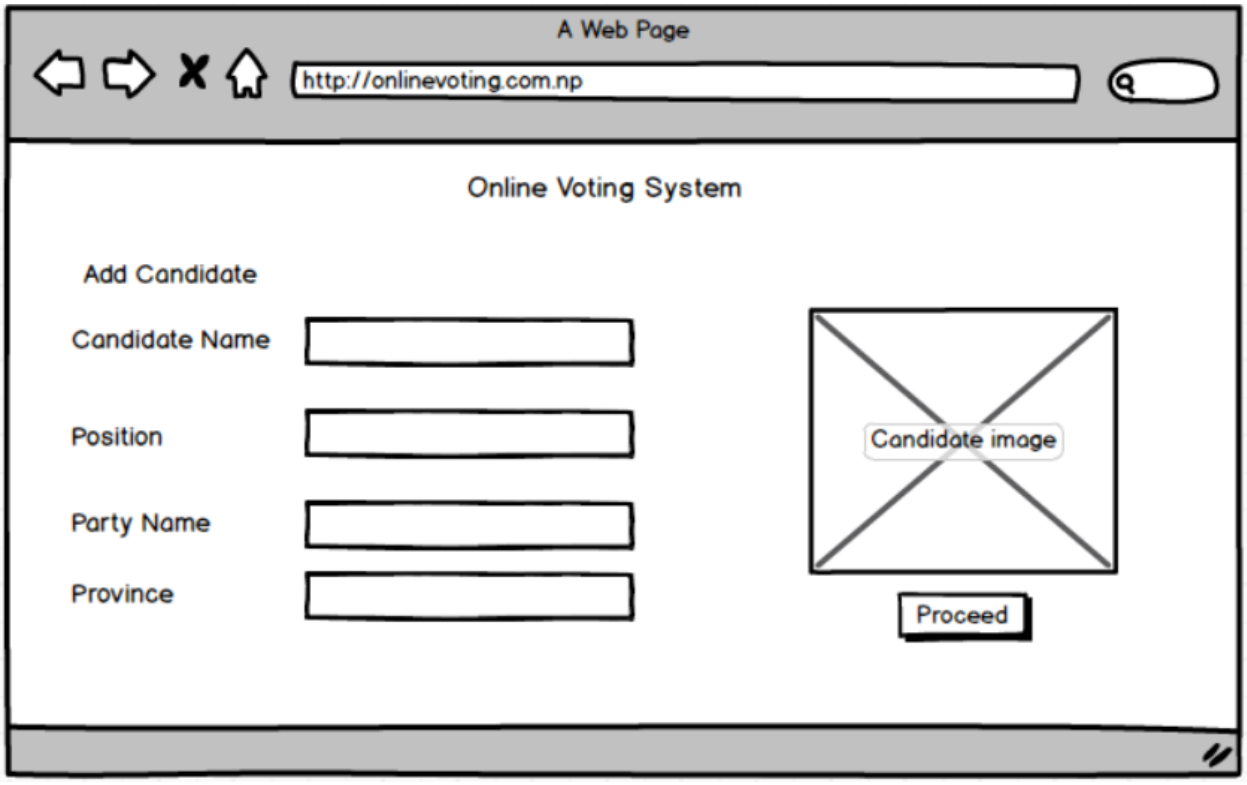


Figure 16: Adding new candidate

Here, the above picture is of add candidate page. It needs to fill the details of candidate such as candidate name and picture in order to add a candidate. By clicking the proceed button, admin can add the candidate by filling up the details of candidate.

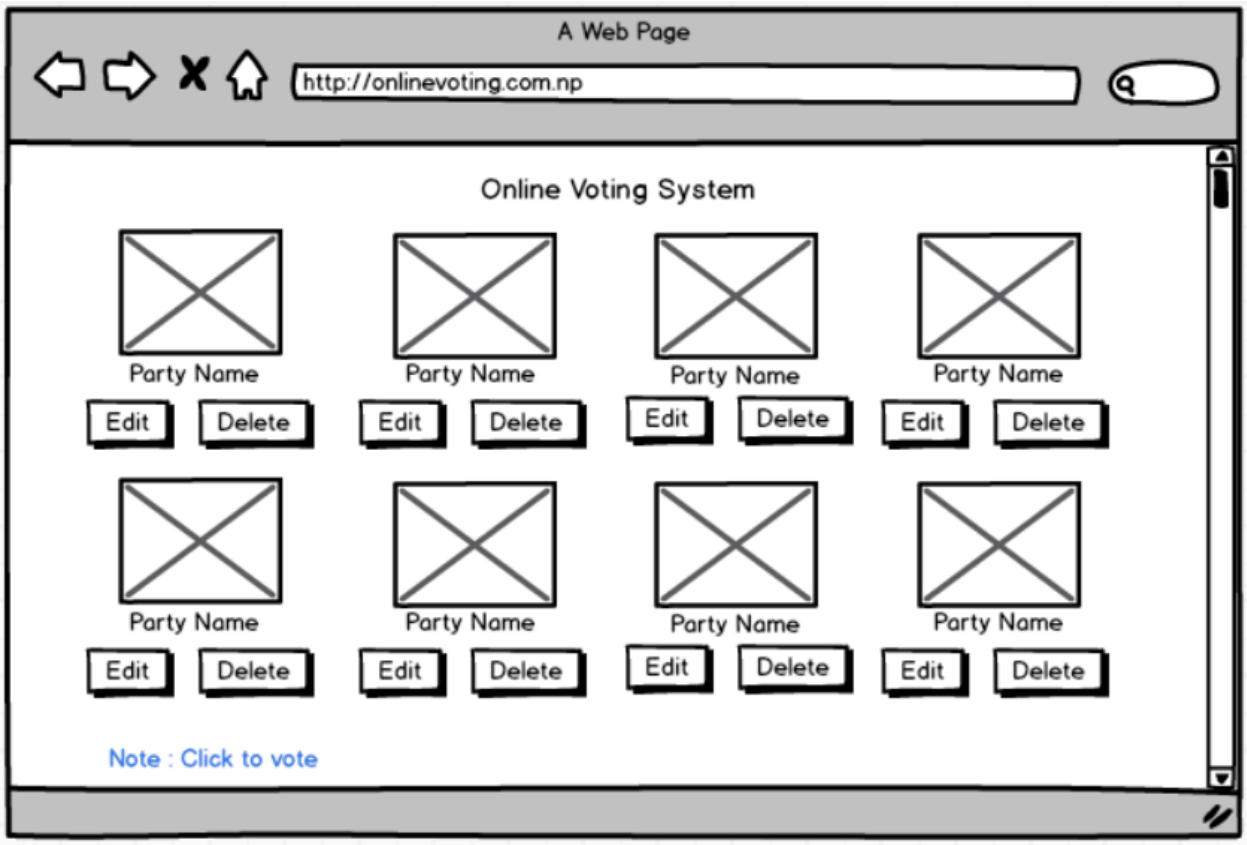


Figure 17: Delete and Edit for party page

Here, the above picture is of delete and edit page for party. If the party didn't take part in election any more, the party should be deleted from the system. So, for the deletion of the party, we should click the delete button. Same as for edit, party name or logo could be change. So, for the edit, edit button is placed.

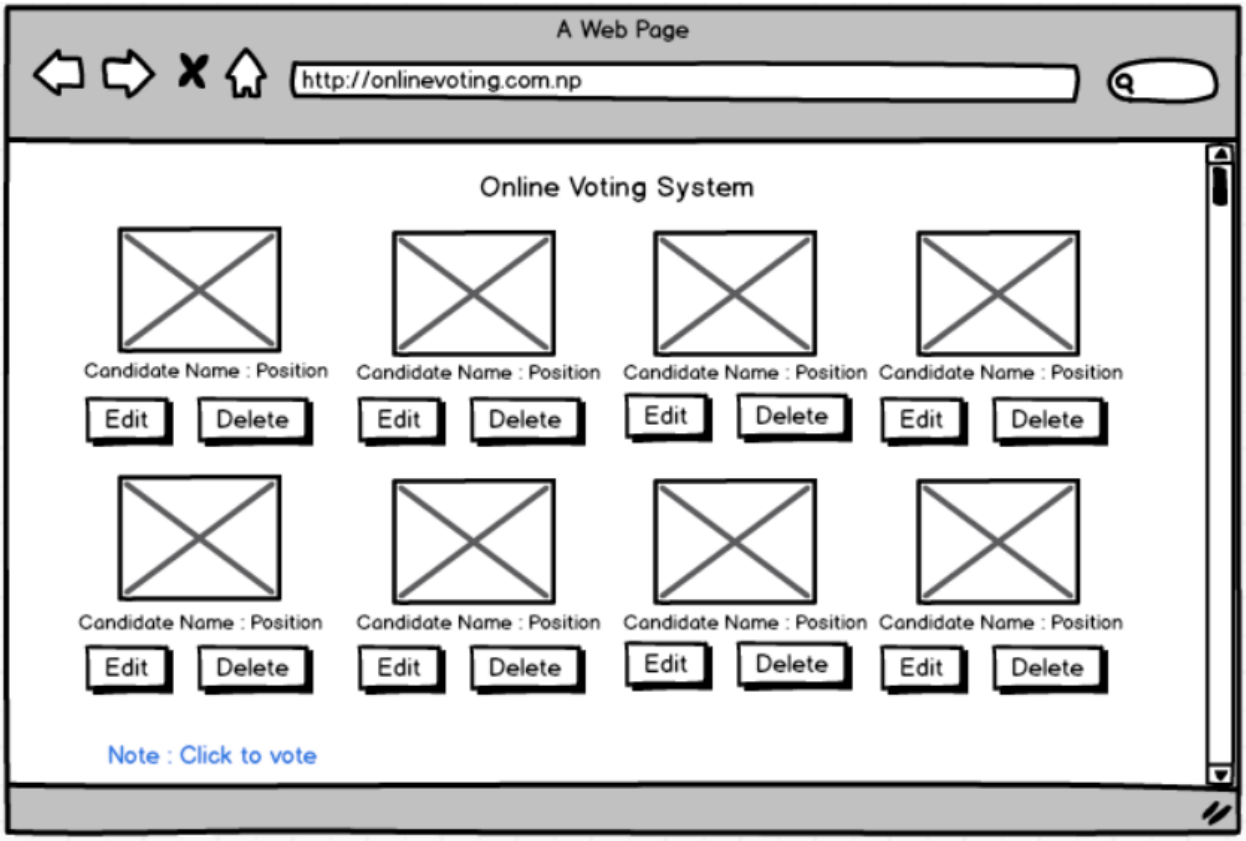
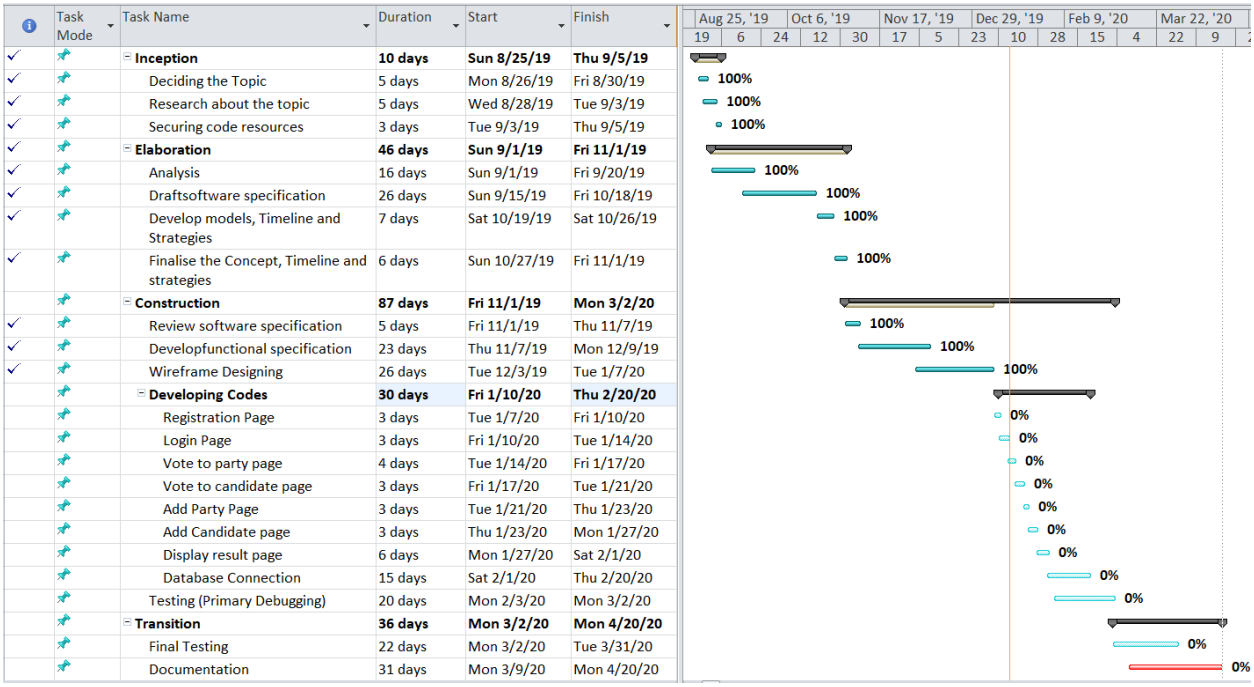


Figure 18: wireframe of delete and edit for candidate page

Here, the above picture is of delete and edit page for candidate. If the candidate didn't take part in election any more, he/she should be deleted from the system. So, for the deletion of the candidate, we should click the delete button. Same as for edit, the position of candidate could be change. So, for the edit, edit button is placed.

Chapter 4: Analysis of progress



Task Mode	Task Name	Duration	Start	Finish
	Inception	**10 days**	**Sun 8/25/19**	**Thu 9/5/19**
	Deciding the Topic	5 days	Mon 8/26/19	Fri 8/30/19
	Research about the topic	5 days	Wed 8/28/19	Tue 9/3/19
	Securing code resources	3 days	Tue 9/3/19	Thu 9/5/19
	Elaboration	**46 days**	**Sun 9/1/19**	**Fri 11/1/19**
	Analysis	16 days	Sun 9/1/19	Fri 9/20/19
	Draftsoftware specification	26 days	Sun 9/15/19	Fri 10/18/19
	Develop models, Timeline and Strategies	7 days	Sat 10/19/19	Sat 10/26/19
	Finalise the Concept, Timeline and strategies	6 days	Sun 10/27/19	Fri 11/1/19
	Construction	**87 days**	**Fri 11/1/19**	**Mon 3/2/20**
	Review software specification	5 days	Fri 11/1/19	Thu 11/7/19
	Developfunctional specification	23 days	Thu 11/7/19	Mon 12/9/19
	Wireframe Designing	26 days	Tue 12/3/19	Tue 1/7/20
	Developing Codes	**30 days**	**Fri 1/10/20**	**Thu 2/20/20**
	Registration Page	3 days	Tue 1/7/20	Fri 1/10/20
	Login Page	3 days	Fri 1/10/20	Tue 1/14/20
	Vote to party page	4 days	Tue 1/14/20	Fri 1/17/20
	Vote to candidate page	3 days	Fri 1/17/20	Tue 1/21/20
	Add Party Page	3 days	Tue 1/21/20	Thu 1/23/20
	Add Candidate page	3 days	Thu 1/23/20	Mon 1/27/20
	Display result page	6 days	Mon 1/27/20	Sat 2/1/20
	Database Connection	15 days	Sat 2/1/20	Thu 2/20/20
	Testing (Primary Debugging)	20 days	Mon 2/3/20	Mon 3/2/20
	Transition	**36 days**	**Mon 3/2/20**	**Mon 4/20/20**
	Final Testing	22 days	Mon 3/2/20	Tue 3/31/20
	Documentation	31 days	Mon 3/9/20	Mon 4/20/20

Figure 19: Gantt Chart of online voting system

Gantt Chart is a chart in which a series of horizontal lines shows the amount of work done or production completed in certain periods of time in relation to the amount planned for those periods.

Here, according to the Gantt chart, the tasks are finished up to wireframe designing part of construction phase. Th start date of the project is August 8th, 2019 and finished date is September 5th. As the project is developing based on RUP methodology. There are four phases in RUP methodology. In inception phase, there are sub tasks such as deciding the topic, research about the topic and securing code resources. For the completion of these task of inception phase, it took 10 days for me. After completion of inception phase, Elaboration phase is started. The start date of Elaboration phase is September 1st, 2019 and finished date is November 1st, 2019. It took 46 days for the completion of this phase. The sub tasks of elaboration phase are analysis, draft software

specification, develop models, timeline and strategies. In this phase, analysis of the project and detail process or working method of the online voting system was done. Work process is separated based on timeline and Gannt chart is created which help in making strategies to complete the project in time. After completion of elaboration phase, Construction phase is started. The start date of Construction phase is october 1st, 2019 and expected to finish in March 2nd, 2020 It took 2 months to complete up to wireframe designing part. In this phase, use case and ERDs is created. Wireframes are design as per to meet the requirements of this project. Back end codes are still left as they are separated for future tasks. The future tasks are described in next chapter.

Chapter 5: Future Work

Construction and transition phase are the remaining part.

In construction phase, use case and ERDs was created. Wireframes were designed. But the back-end codes are remaining to do. And other tasks are also left such as: connecting to database. I will use PHP Storm application to create web design and to write code for database connection. I will use oracle database to store data.

In transition phase, testing part is left. For examples, by clicking the result page, will it show results or not? Will the login account of the voters will store in database or not?

Figure - Reference (Chapter 4)

Chapter 6: References

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Chapter 7: Appendix

Gantt Chart Benefits

1. Clarity

One of the biggest benefits of a Gantt chart is the tool's ability to boil down multiple tasks and timelines into a single document. Stakeholders throughout an organization can easily understand where teams are in a process while grasping the ways in which independent elements come together toward project completion.

2. Communication

Teams can use Gantt charts to replace meetings and enhance other status updates. Simply clarifying chart positions offers an easy, visual method to help team members understand task progress.

3. Motivation

Some teams or team members become more effective when faced with a form of external motivation. Gantt charts offer teams the ability to focus work at the front of a task timeline, or at the tail end of a chart segment. Both types of team members can find Gantt charts meaningful as they plug their own work habits into the overall project schedule.

4. Co ordination

For project managers and resource schedulers, the benefits of a Gantt chart include the ability to sequence events and reduce the potential for overburdening team members. Some project managers even use combinations of charts to break down projects into more manageable sets of tasks.

5. Creativity

Sometimes, a lack of time or resources forces project managers and teams to find creative solutions. Seeing how individual tasks intertwine on Gantt charts often encourages new partnerships and collaborations that might not have evolved under traditional task assignment systems.

6. Time Management

Most managers regard scheduling as one of the major benefits of Gantt charts in a creative environment. Helping teams understand the overall impact of project delays can foster stronger collaboration while encouraging better task organization.

7. Flexibility

Whether you use Excel to generate Gantt charts or you load tasks into a more precise chart generator, the ability to issue new charts as your project evolves lets you react to unexpected changes in project scope or timeline. While revising your project schedule too frequently can eliminate some of the other benefits of Gantt charts, offering a realistic view of a project can help team members recover from setbacks or adjust to other changes.

8. Manageability

For project managers handling complex assignments, like software publishing or event planning, the benefits of Gantt charts include externalizing assignments. By visualizing all of the pieces of a project puzzle, managers can make more focused, effective decisions about resources and timetables.

9. Efficiency

Another one of the benefits of Gantt charts is the ability for teams' members to leverage each other's deadlines for maximum efficiency. For instance, while one team member waits on the outcome of three other tasks before starting a crucial piece of the assignment, he or she can perform other project tasks. Visualizing resource usage during projects allows managers to make better use of people, places, and things.

10. Accountability

When project teams face major organizational change, documenting effort and outcomes becomes crucial to career success. Using Gantt charts during critical projects allows both project managers and participants to track team progress, highlighting both big wins and major failures. During professional review periods, team members who frequently exceed expectations can leverage this documentation into larger raises or bonuses.

(Bright Hub Project Management, 2020)