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HELWAN UNIVERSITY

Faculty of Engineering

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Digital transformation of Egyptian parliamentary election

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Abstract

The Ministry of Communications and Information Technology seeks to build a digital Egypt and reach an Egyptian society that deals digitally in all aspects of life depending on the plan of 2030 that all the agencies would depend on digital systems. Which promotes the development of information and communication technology infrastructure and improves digital services in governmental agencies. The digital transformation concept in Egypt is based on shifting the paperwork to automated system. The traditional way for Electoral screening stage is very complex and expensive and takes long time to announce the results. So, we will save a lot of time and money by changing the traditional way of elections to the digital way and we will keep away from suspicions and no one could ask about the truthfulness of the result as the system can't be modified nor manipulated.

The project is an Egyptian election system which make the user able to vote without the traditional way of the voting. The customer service can add all the data to the system of the electors, candidates, governorates, circles, lists, general circles, judges and chairman of the Supreme Electoral Commission. The elector can login to the system to vote for the candidates in his circle and one list in his general circle.

The general committee judges and the subcommittee judges can confirm the votes of electors. The chairman of the Supreme Electoral Commission can show the result of the lists and candidates.

We add the Blockchain to the system which holds the data in blocks which ensures that the votes can't be modified by anyone.

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Chapter 1: Introduction

In this chapter we will discuss the theoretical overview of the system, discuss our motivation that lead us to implementing this project, the problem we are trying to solve and the project phases we went through to come up with this system.

1.1 Theoretical overview

The Parliamentary Election in Egypt is divided in two categories as shown In figure 1:

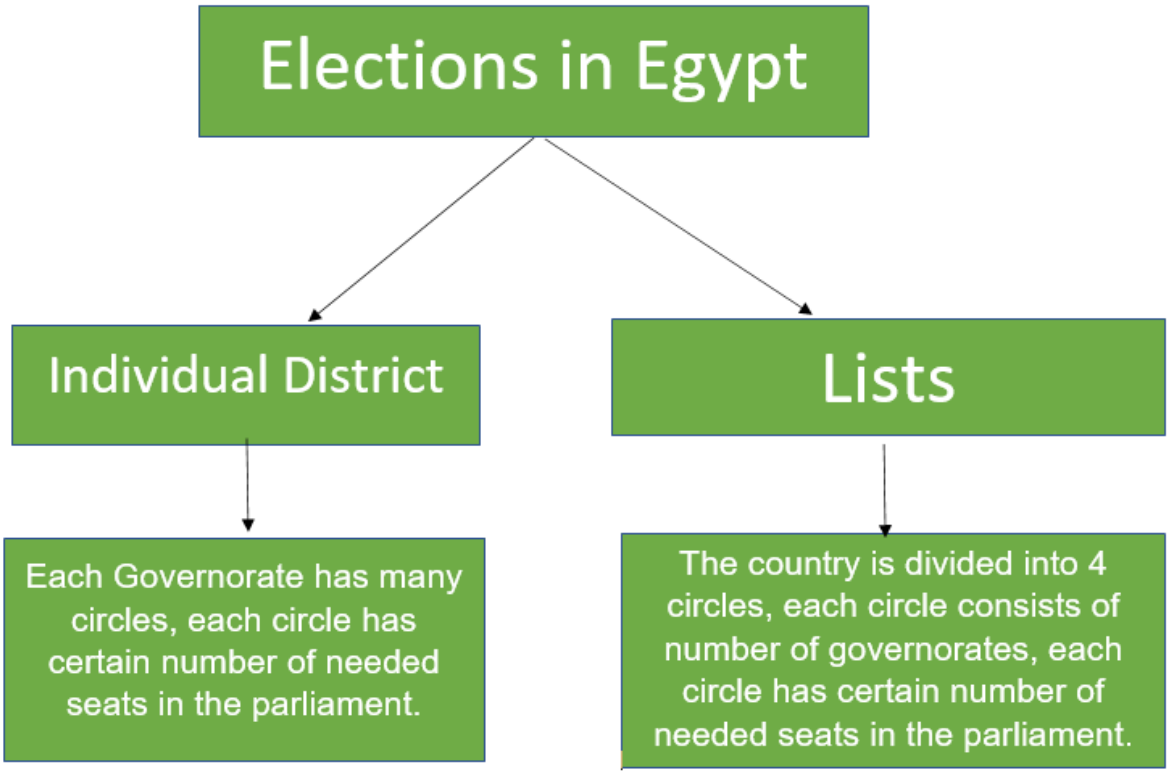

Figure 1:Elections in Egypt

The voting process has to be proceeded in five steps as shown in figure 2:

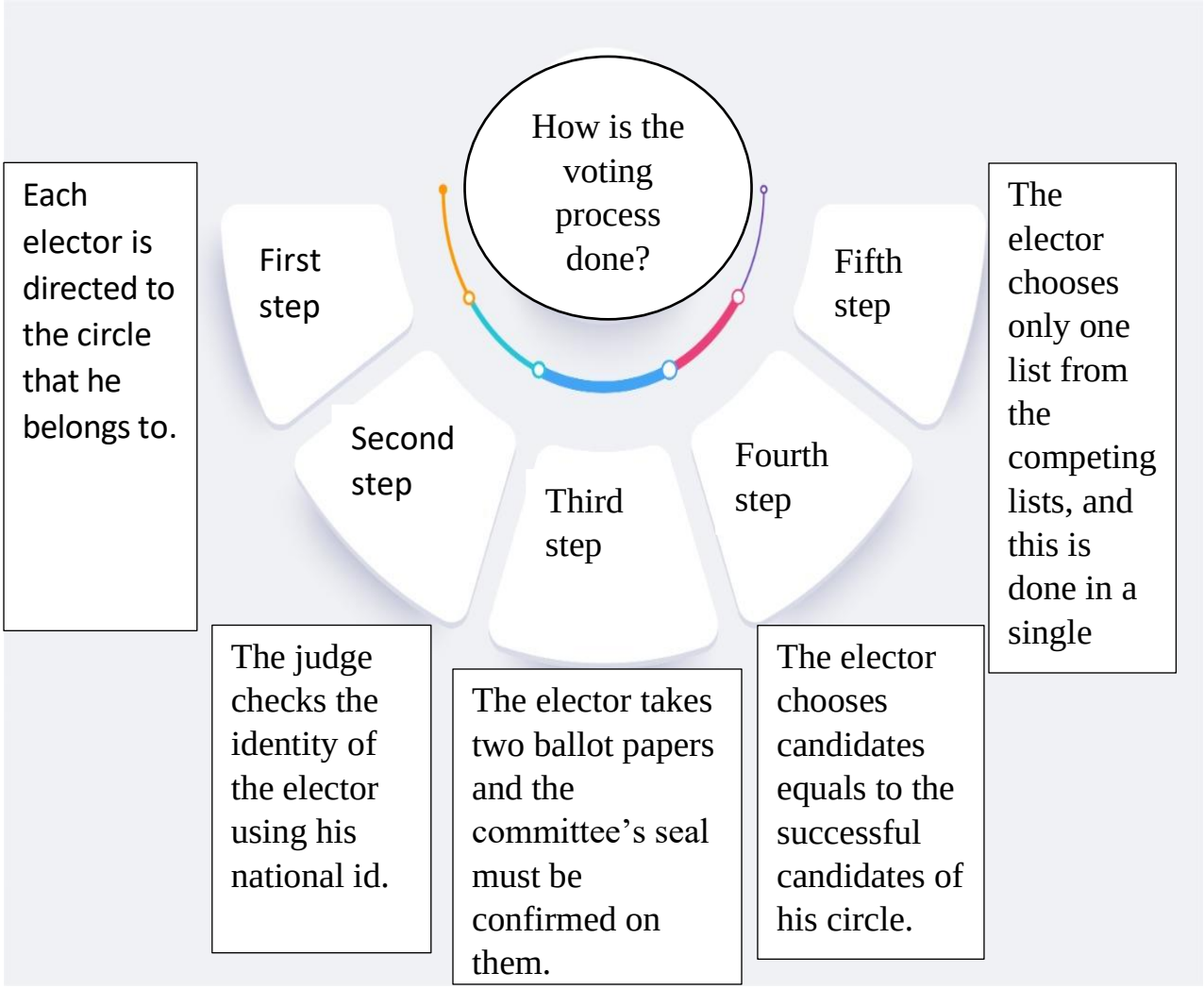

Figure 2: How is the voting process done?

The traditional way of voting is based on papers that have candidates and lists. Each elector checks candidates and list and put the paper in the election box as shown in figure 3. But what happens if he intentionally put a false vote? In the

traditional way, judges can't take a false vote and they just ignore it

Figure 3: The elector Puts the papers in the candidates and list funds

At the end of the elections, all subcommittees check the papers in their candidates' fund and lists' fund and then each subcommittee judge will confirm these papers and give it to the general committee judge who is in the same general committee. Then the general committee judge confirms it and give it to the chairman of the Supreme Electoral Commission to announce the final result of the election by calculating the number of votes for each candidate and each list to determine whom are the successful candidates and successful list.

This traditional way of election has many problems like that the result takes a long time to be announced. There are some people doubt the result of the election because there are many fraud incidents that have been recorded in some websites and all people talked about it and this way is expensive because it needs huge

number of resources and huge number of judges and people who take care of this elections. So, to solve these problems we decided to convert the election from this traditional way to digital way.

The main idea behind the project is the Egyptian election in Egypt and how to change it to become more automated and easy for all the entities who interact with the system. The elections are composed of two stages (first election and second election). Egypt is divided into numbers of general circles. Each general circle includes a numbers of the governorates and each governorate include a number of circles. Each circle contains a numbers of electors and electors are going to vote for the candidates in their circles. Each general circle contains lists. The elector can vote for one list. Lists can be in more than one general circle. The subcommittee judge checks each elector and if that elector has the right to vote or not. After the voting process is done, they sign on the electors' list to be confirmed. This is done in each circle in the country. After the first election is done, some of candidates are moved to the second election and some of candidates succeed in the first election if they pass the 50% number of votes. But in case of the lists, there is one list only should succeed. If a list succeeded in the first election, no lists will be moved the second election.

A simulation from the traditional way of voting for one list as shown if figures 4 and 5. However, Elector can check two lists and his vote will become false vote.

Figure 4: election card of the lists in The traditional way

Figure 5: elector votes for one list

1.2 Motivation

The vision of 2030 that Egypt will be turned into digital transformation, so our goal here to change and transform the traditional way of the voting by using technologies to a digital way, to speed up and save cost for the election count process and the result will be more accurate and more secure. And to help our country to move to a better place amongst the digital countries.

1.3 Problem Statement

The problem we are trying to solve has three main issues as shown in figure 6.

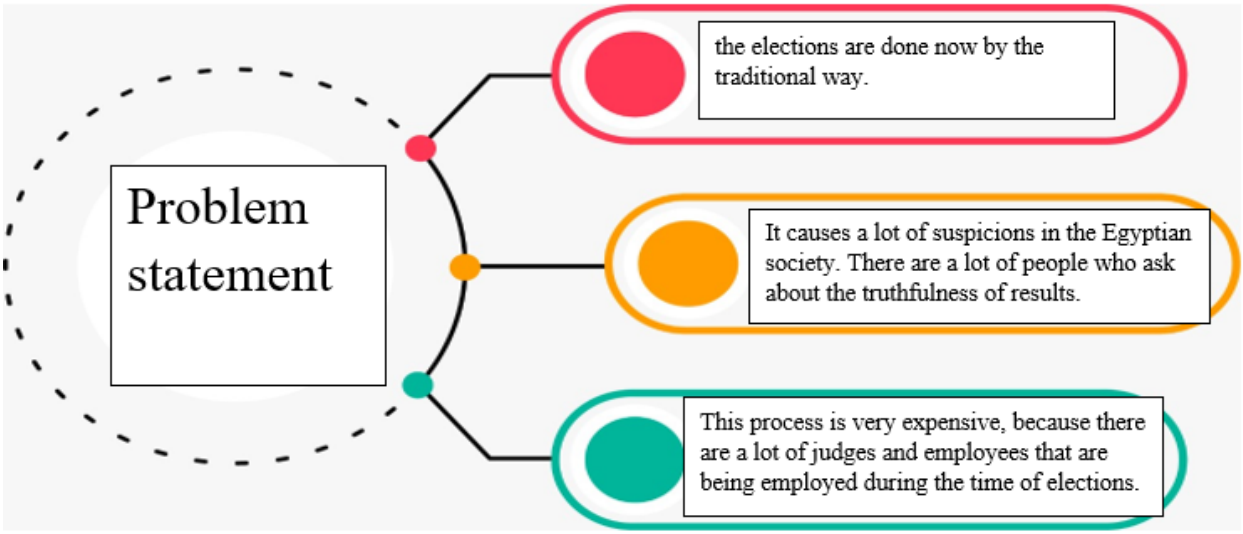

Figure 6: Problem Statement

Egyptian parliamentary election is taking a lot of human resources, money and time to announce the result of the election. Egypt is moving forward to the digital transformation of governmental authorities. Hence, we worked on a solution that has never been applied before and that is to transform the traditional way of election to a digital way. It's known that the election must be highly secured against any sort of manipulation, error, data leak, invulnerability or faulty mistakes. The phases of traditional election are as follows:

- data entry of electors that are 18 years or above, assign judges to committees, candidates which are 25 years or above and lists amongst general circles of Egypt.

- Electors know their election circle, subcommittee and general committee and head to their assigned subcommittee to vote for a number of candidates that is assigned to their circle and one list.
- Announcing the result of the first election and move some candidates and lists to the second election if there's a conflict in votes and they didn't reach the 50% or more votes.
- Starting the second election and repeat the steps of first election.

We apply those phases in a digital manner using latest technologies of software development with highly secured data against manipulation, faulty errors and human mistakes.

1.4 Project Phases

1) MERN stack:

Stack: it refers to a combination of coding languages, tools, and frameworks developers use to the clients. It is divided into two parts:

1) Client-side frontend: (HTML, CSS, JavaScript, react JS, programming language).

2) Server-side backend: (Web server, programming language, web framework, databases).

MERN: MERN includes the following open-source components as shown if figure 7:

- Mongo DB
- Express JS

- React JS/ Redux
- Node JS

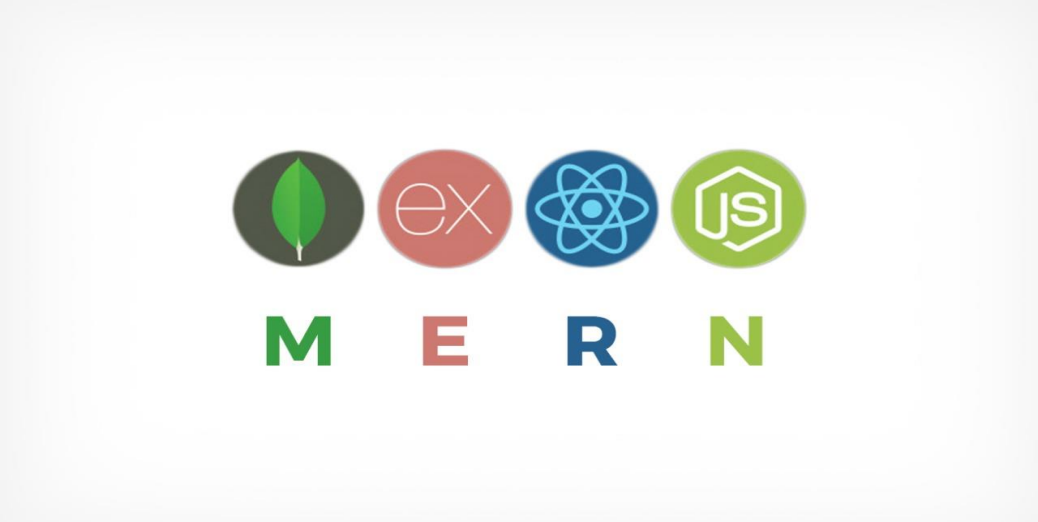

Figure 7: MERN Stack

1)Mongo DB: this is a free open-source, cross-platform document-oriented database program. It is classified as a No SQL database program, which means that data is stored in flexible documents with JSON-based query language. This also means that the size of the content number of fields in the documents tends to vary and changes. The whole data is structured in a way to be prone to change over time as shown in figure 8.

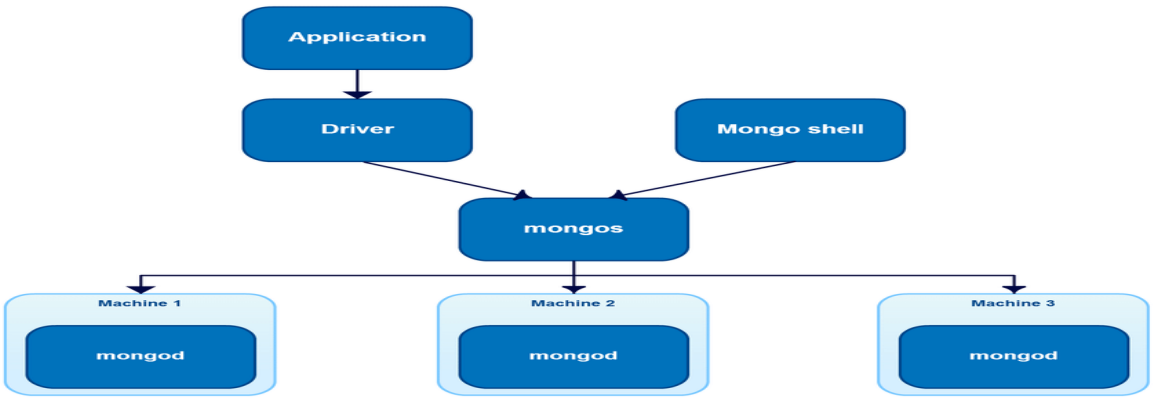

Figure 8: MongoDB

2)Express JS: This is also a free, open-source software, and it can be classified as a web application framework for Node.js. To be more precise, Express JS is made for developing web apps and APIs.

Instead of manually writing full web server code in Node.js, developers use this MERN component to simplify the coding process. The best feature of this framework is that developers do not repeat the same code over and over, as they would with writing Node.js code in the HTTP module as shown in figure 9.

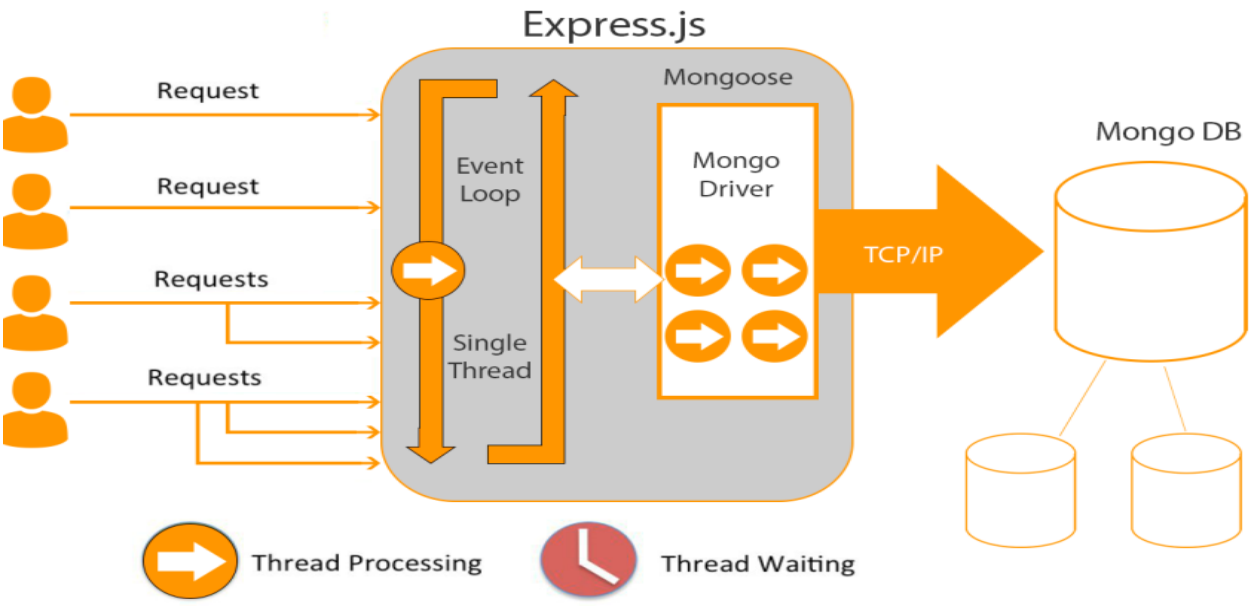

Figure 9: Express JS

3)React JS: This is a JavaScript library used for building user interfaces,

This specific library is often used for creating views rendered in HTML. The views that you create in Reach declarative, which means that you do not have to deploy additional time on managing the changes and effects they have on the data.

React uses a full-featured programming language (JavaScript) to construct repetitive or conditional DOM elements, which is a huge plus. You do not need to rely on template to automate creation of repetitive HTML and DOM elements as shown if figure 10.

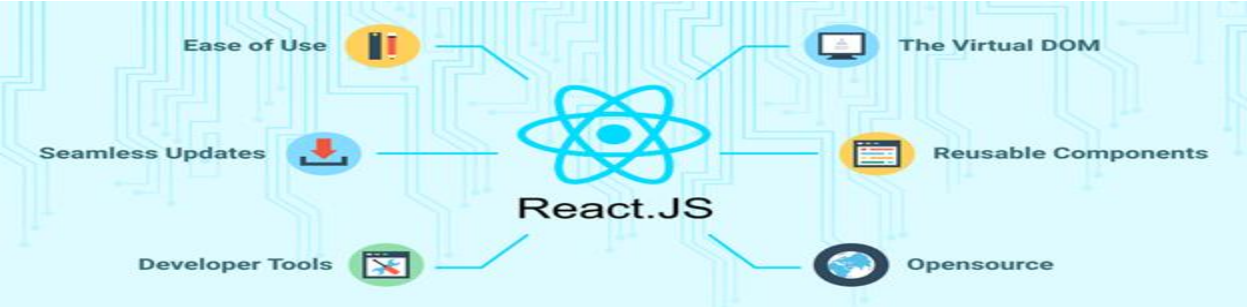

Figure 10: React JS

4)Node JS: JavaScript was originally used for front-end scripting, but Node JS has enabled developments to use it to write command line tools and back-end scripts for the purpose of creating dynamic web page content before the page is sent to the user's web browser.

Node JS was designed with an idea of allowing developments to build scalable network applications as shown if figure 11.

Figure 11: Node JS

Why are we using the MERN stack?

- The whole system consists of frontend, backend and the REST API which acts as a middleware for the application and it connects the application as pieces in a puzzle.
- In the backend, it deals with server to secure data comes and send to server, and server deals with database to store and get needed data.
- We use this stack because everything is done by using Javascript. It is used in the frontend and the backend. So. There is no need for context switching.
- By using react JS, it involves having a web application accessed from a single web page. This avoids loading a new page with each action.

2) DevOps: is a set of practices that works to automate and integrate the processes between software development and IT teams, so they can build, test, and release software faster and more reliably as shown if figure 12.

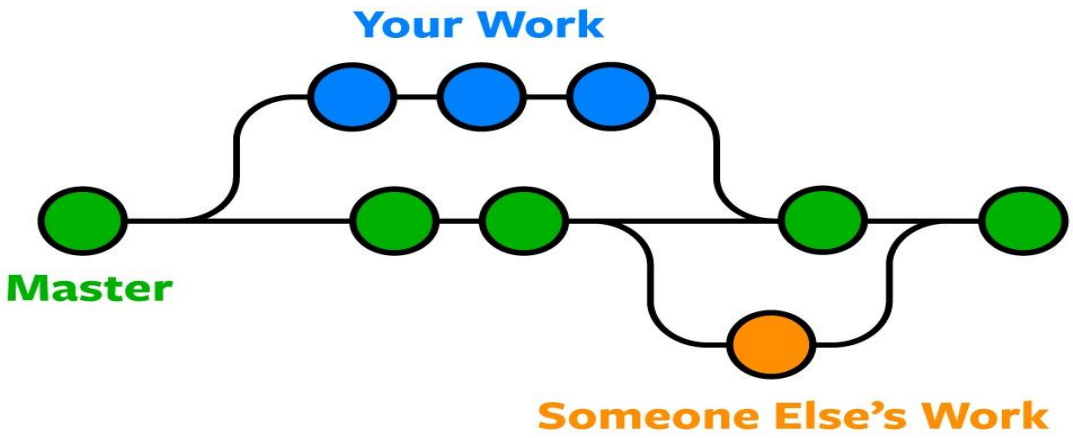

Figure 12: DevOps

- **Docker:** is an open platform for developing, shipping, and running applications. It enables us to separate the application from the infrastructure so we can deliver software quickly. We can manage our infrastructure in the same ways we manage our applications as shown if figure 13.

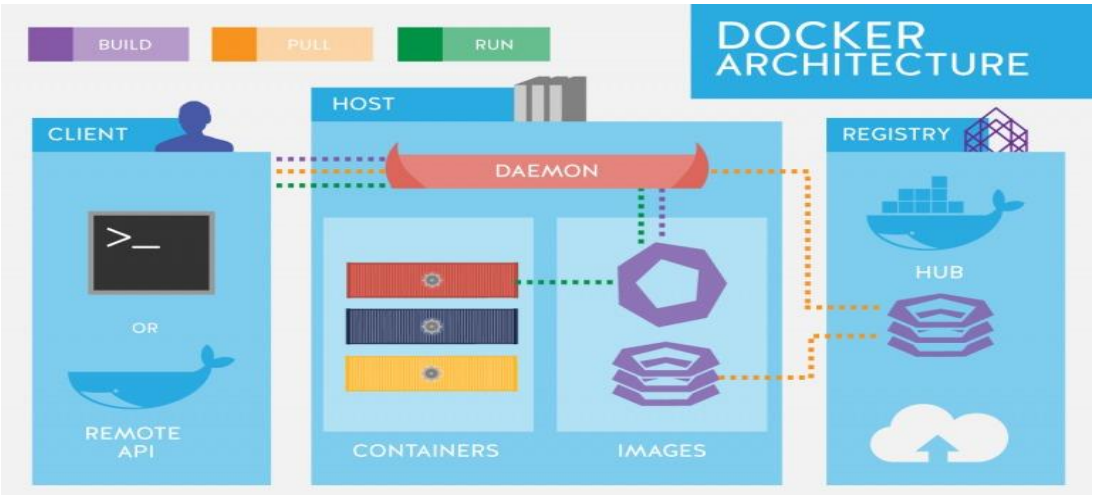

Figure 13: Docker

- **Kubernetes:** is a portable, extensible, open-source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation. It has a large, rapidly growing ecosystem. The name Kubernetes originates from Greek, meaning helmsman or pilot as shown in figure 14.

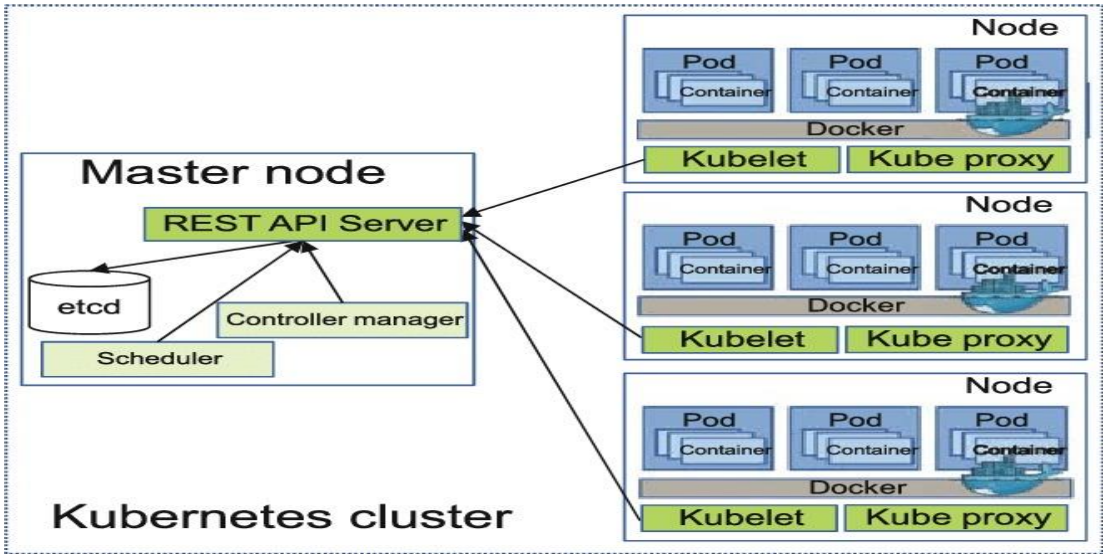

Figure 14:Kubernetes

- **Jenkins:** is an open-source automation tool written in Java with plugins built for Continuous Integration purposes. Jenkins is used to build and test the software project continuously making it easier to integrate changes to the project and making it easier for users to obtain a fresh build. It also allows us to continuously deliver the software by integrating with many testing and deployment technologies as shown if figure 15.

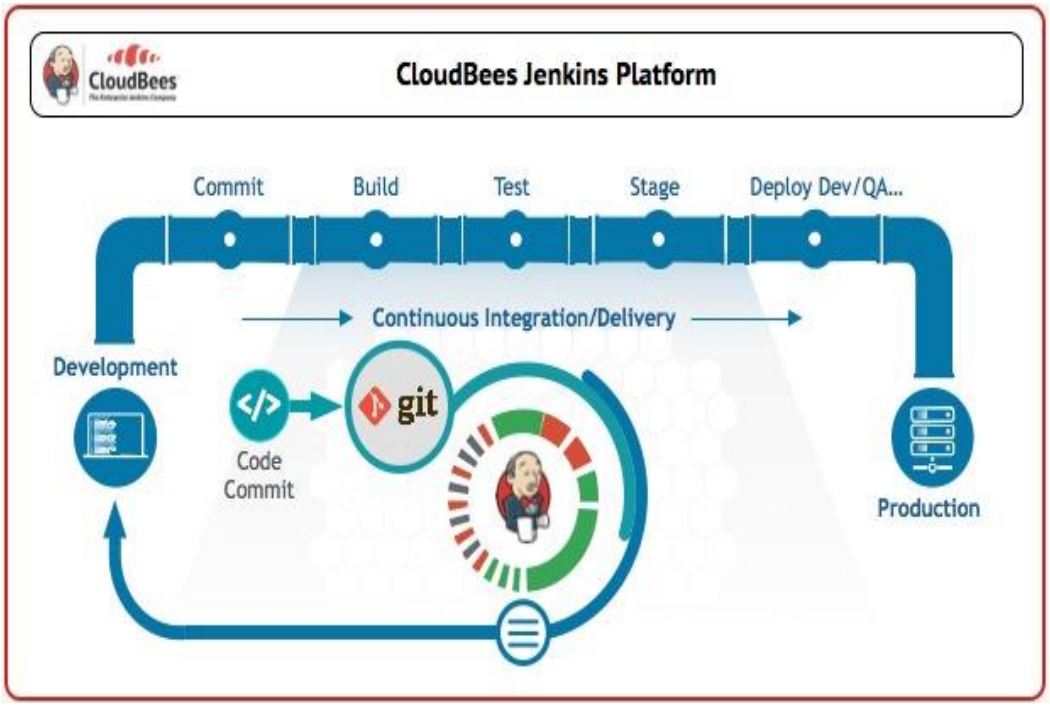

Figure 15:Jenkins

Chapter 2: Literature Review

In this chapter we will discuss the implementation of the system that was proposed in other countries.

Back to National Election authority there was no online electoral system that has been implemented in Egypt and Sum of election rules are [1]:

- The elections will take place in two phases, the first phase in 14 governorates and the second phase in 13 governorates.
- The country is divided into 4 general circles, each general circle consists of numbers of governorates, each circle has certain numbers of seats in the parliament for lists.
- Each Governorates has many of circles, each circle has certain numbers of needed seats in the parliament for candidates.

Online election can be implemented by two different ways [2]:

- E-voting which is physically supervised by representatives of governmental or independent electoral authorities (e.g. electronic voting machines located at polling stations).
- Remote e-voting via the Internet (also called i-voting) where the voter submits his or her vote electronically to the election authorities, from any location.

Some countries have implemented an electronic election system through machine in election commission as [3]:

- In October 2001 electronic voting was used for the first time in an Australian parliamentary election. In that election, 16,559 voters (8.3% of all votes counted) cast their votes electronically at polling stations).

- Since 2000, all Brazilian elections have been fully electronic. By the 2000 and 2002 elections more than 400,000 electronic voting machines were used nationwide in Brazil and the results were tallied electronically within minutes after the polls closed.

Other countries have applied it via the internet as:

- Estonia became the first country to have legally binding general elections using the Internet as a means of casting the vote. The option of voting via the Internet in the local election was available nationally.
- In September 2000, the European Commission launched the CyberVote project with the aim of demonstrating "fully verifiable on-line elections guaranteeing absolute privacy of the votes and using fixed and mobile Internet terminals". Trials were performed in Sweden, France, and Germany.

Chapter 3: Proposed System

In this chapter we will discuss the system we are implementing and how we differ from other implementations of the same system in other countries.

Each phase of the election is applied to apply data integrity and security and prevent any type of manipulation.

1- Data entry phase

A customer service representative can add Electors as shown in figure 16 using selections to keep the data integrity of the system and trying the best we can to keep the data as clean as possible with constraints that doesn't accept numbers or special characters in the name field and only numbers in national ID field.

Figure 16: Add elector

We viewed the system as the following. Egypt is categorized into Four general circles each general circle involves of multiple governorates and each governorate has many circles within it and each circle has many general committees and each general committee involves of different subcommittees.

We enter the data in this manner from top to bottom to enforce data integrity. Customer service representatives can enter candidates after entering each the circles with a condition that each governorate has at least one circle. They can enter electors, judges, election, supreme electoral commission and themselves included after entering subcommittees with a condition that each general committee must have at least one subcommittee. This way of entering data is done because we assign selections of existing data to newly added data. Without human errors of assigning false data to the system.

2- Voting phase

A subcommittee judge opens the system for electors in his subcommittee using his own national ID and password to. Then an elector can enter his national ID to the system and enter the system. Elector can move to voting area to view the candidates in his circle as shown in figure 17.

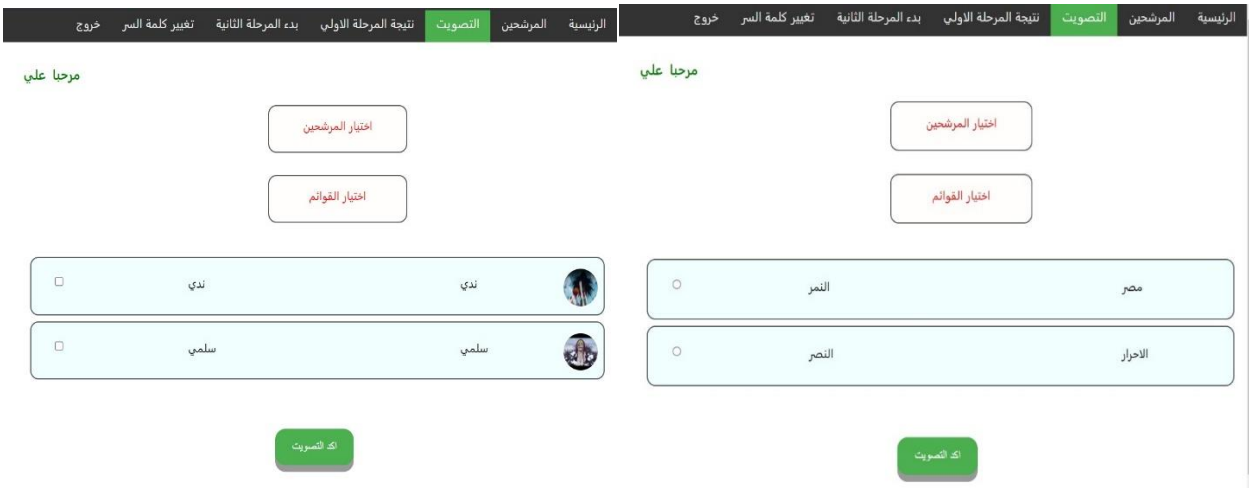

Figure 17: Voting Phase

Customer service representatives, judges, supreme electoral commission are electors with a benefit of voting without having to leave their duties and go to

their assigned subcommittees using their password to enter the system at once. Only subcommittee judges can open the system for electors. Each circle has an assigned number of candidates to succeed in the election. Electors choose the assigned number of candidates and one list and submit their vote. Vote can only be sent to the server if the elector chose the correct data. And electors are prohibited from voting again once their vote has been successfully submitted.

Votes that enter the system are entered as the following:

- Encrypted national ID of the candidate for candidates and encrypted list name for lists
- Encrypted national ID of the elector, for later purposes of checking if the data that entered the system are really true.
- A checking icon from the general committee judge that has witnessed the lists of electors that voted in this day.
- A checking icon from the subcommittee judge that has witnessed the lists of electors that voted in this day.

3- Result phase

We decrypt the data of candidates and lists, count the number of their occurrence in database, assign these counts to them, sort the candidates and lists according to their counts. For candidates we sort candidates within their assigned circles so that each circle has the candidates sorted with the highest candidates to lowest. And for lists we sort them according to general lists. For lists, the system announces one list to be successful if it has more than 50% of the votes. Otherwise, the highest two lists are moved to second election.

For candidates we choose the candidate with more than 50% of the votes according to his assigned circle and move the top most candidates that is needed to fill the number of assigned candidates to succeed in a circle to the second election. Only the chairman of Supreme Electoral Commission can view the result of the two election phases and start the second phase of election after viewing the first phase of election as shown in figure 18.

Figure 18: First election result of candidates

4- Second election phase

The remaining candidates and lists will be shown in the system and get their votes by electors according to the rules that’re mentioned in the first election phase and the result is announced.

Chapter 4: Analysis and Requirements

In this chapter we will discuss the system functional requirements, nonfunctional requirements, agile scrum backlogs and use cases.

4.1 System Requirement:

a. Functional requirements:

ID	Requirements
REQ-Elector	- Should be able to vote for a number of candidates mentioned in his circle. - Should be able to vote for only one list. - Can only submit his vote once he completes choosing specified number of candidates and 1 list.
REQ-Judges	- Should be able to search for electors in their subcommittee to check their eligibility of voting.
REQ-subcommittee judges	-Should be able to search for electors in their subcommittee to check their eligibility of voting. - Should be able to see a list of all electors in their subcommittee and submit their approval of elections in their sub-committee.
REQ- General committee judges	- Should be able to search for any elector in their general committee. - Should be able to see a list of all sub committees in their general committee where each sub-committee contains the list of electors in the sub-committee. Then he can submit his approval of elections in his general committee.
REQ-Customer service	- Can add governorate, circle, general committee and sub committees in this order where each governorate has circles and each circle has general committees and each general committee has sub committees. - Can add electors, candidates, judges, sub-committee judges and general committee judges once each governorate has at least one circle and each circle has at least one general committee and each general committee has at least one sub-committee.

REQ- Supreme Elections Committee	- Committee should be able to view result that contains the successful candidates and lists once the first election is finished. - Should be able to start the second election after the first election is finished.

Table 1: Functional Requirements

b. Non-function requirements:

ID	Requirements
REQ- Availability	- The system should be available all day long during election time. -Using Kubernetes to run 2 or more container to guarantee that project still work if running container failed.
REQ- Security	- Customer Information secured by system like national id, name and all information entered in database.
REQ- Safety	- Server will be locked and protected via password that are assigned to judges, customer service representatives and chairman of the Supreme Electoral Commission to guarantee it will not be accessible to anyone on the internet.

Table 2: Non-function requirements

c. Function requirement specification:

1. Stakeholders

a. Customer service
   - Responsible of entering data to system.

b. Electors
   - View candidates.
   - Vote for candidates and lists.

c. Judge
   - Responsible of checking voters.

d. Sub-committee judge
    - Responsible of sending voter's list to chairman of the general committee.
e. Supreme elections commission
    - Responsible of viewing results.
f. Chairman of the general committee
    - Responsible of viewing voter's list.
    - Send voter's list to chairman of the general committee.

4.2 Actors and Goals:

Customer service: Enter and edit all data for candidates, electors, chairman of Supreme Electoral Commission, judges, general circles, governorates, circles, general committee, subcommittees, lists and parties.

Elector: Can view candidate and vote for individuals and lists.

Judge: Check voters.

Sub-committee judge: Send voter's list to chairman of the general committee.

Supreme elections commission: View results of first election, start second election and view results of second election.

Chairman of the general committee: View voter's list and send them to the supreme election commission.

4.3 Backlog

Epic	User story	Task
Customer service area	As a customer service representative I want to add governorate, circle, general committee and subcommittee in this order so I support the concept of that each governorate has circles, each circle has general committees and each general committee has subcommittees.	Add governorate.
		Show add circle field only if there's at least one governorate.
		Add circle attached to a governorate.
		Show add general committees section only if there's at least one governorate and each governorate has at least one circle.
		Add general committee attached to circle and governorate.
		Show add subcommittees section only if there's at least one governorate and each governorate has at least one circle and each circle has at least one general committee.
		Add subcommittee attached to general committee, circle and governorate.
		Show add elector section only if there's at least one governorate and each governorate has at least one circle and each circle has at least one general committee and each general committee has at least one subcommittee.
		Show add judge section only if there's at least one governorate and each governorate has at least one circle and each circle has at least one general committee and each general committee has at least one subcommittee.
		Show add subcommittee judge section only if there's at least one governorate and each governorate has at least one circle and each circle has at least one general committee and each general committee has at least one subcommittee.
		Show add general committee judge section only if there's at least one governorate and each governorate has at least one circle and each circle has at least one general committee and each general committee has at least one subcommittee
		Show add candidate section only if there's at least one governorate and each governorate has at least one circle and there's at least one party.
		Show add customer service representative section only if there's at least one governorate and each governorate has at least one circle and each circle has at least one general committee and each general committee has at least one subcommittee.

		Show add supreme elections commission section only if there's at least one governorate and each governorate has at least one circle and each circle has at least one general committee and each general committee has at least one subcommittee
	As a Customer Service, I want to add customer service actors, supreme elections committee, electors, candidates, judges, subcommittee judges, general committee judges, parties and lists so they can know all information about themselves.	Add judge attached to his governorate, circle, general committee, subcommittee, works in governorate, works in circle, works in general committee and works in sub committee
		Add lists
		Add party
		Add subcommittee judge attached to his governorate, circle, general committee, subcommittee, works in governorate, works in circle, works in general committee and works in sub committee
		Add general committee judge attached to his governorate, circle, general committee, subcommittee, works in governorate, works in circle and works in general committee.
		Add customer service representative attached to his governorate, circle, general committee, sub committee
		Add chairman of Supreme Electoral Commission attached to his governorate, circle, general committee, subcommittee
Electors area	As an Elector, I want to know information about each candidate in my circle so that I can choose the best candidates for me.	Show candidates for elector based on his circle in get candidates area.
	As an Elector, I want to vote for candidates in individual system depending on the number of successful candidates in my circle. So I can do my role to the country to help it to be better.	Make the circle's number of successful candidates available to electors.
		Voting has two pages, one shows candidates in the elector's circle and the other one shows the lists to the elector.
		Show candidates for elector based on his circle in the voting area.
	As an Elector, I want to vote for one list in lists system so I can do my role to the country to help it to be better.	Elector chooses number of candidates equal to the successful candidates in his circle and one list. otherwise, voting can't be done
		Elector is automatically signed out after successfully voting

Judges area	As a Judge, I want to search for any elector in my subcommittee so I can know information about this elector and know if he had voted or not.	Judges search for an elector in their subcommittee
	As a Subcommittee Judge, I want to search for any elector in my subcommittee so I can know information about this elector and know if he had voted or not.	Subcommittee judges search for an elector in their subcommittee
	As a Subcommittee Judge, I want to see a list of all electors in my subcommittee so I can know who of these electors voted and who did not vote.	Subcommittee judge views the electors' list in his subcommittee
	As a Subcommittee Judge, I want to submit my approval of the list of electors in my subcommittee so I tell my general committee judge that I am agree with the content of this list.	Subcommittee judge submits electors' votes in his subcommittee
	As a General Committee Judge, I want to search for any elector in my general committee so I can know information about this elector and know if he had voted or not.	General committee judges search for an elector in their general committee
	As a General Committee Judge, I want to choose any subcommittee in my general committee to see a list of all electors in this subcommittee so I can know who of these electors voted and who did not vote.	General committee judge get all subcommittees in a general committee for the general committee judge along with their electors
	As a General Committee Judge, I want to submit my approval of all lists of electors in my general committee so I tell the supreme elections commission that I am agree with the content of this list.	General committee judge submits electors' votes in his general committee

Chairman of the Supreme Electoral Commission area	As a Chairman of the Supreme Electoral Commission, I want to view the result of successful candidates of first election.	View the result of successful candidates in a circle
	As a Chairman of the Supreme Electoral Commission, I want to view the result of successful lists of first election.	View the result of successful lists in general circles
	As a Chairman of the Supreme Electoral Commission, I want to move the nearest successful candidates and lists to the second elections	Make the Chairman of the Supreme Electoral Commission start the second election after viewing candidates and lists' results
	As a Chairman of the Supreme Electoral Commission, I want to view the result of successful candidates of second election.	View the result of successful candidates in a circle for second elections
	As a Chairman of the Supreme Electoral Commission, I want to view the result of successful lists of second election.	View the result of successful list in a general circle for second elections
Login system	As a judge I want to be able to vote as an elector without leaving my work place as a judge	System opens for judges and shows the judges area and electors area only
	As a subcommittee judge, I want to be able to be the only one responsible of opening the system to electors	Subcommittee judge open the first layer of login system and face another layer to open the system for electors
	As a customer service representative, I want to be able to vote as an elector without leaving my work place	System opens for customer service with customer service area and elector area.
	As a chairman of the Supreme Electoral Commission, I want to be able to vote without leaving my work place.	System opens for Chairman of the Supreme Electoral Commission and shows the election result, starting the second election and electors area

Table 3: Backlog

4.4 Use cases:

i) Use case diagram:

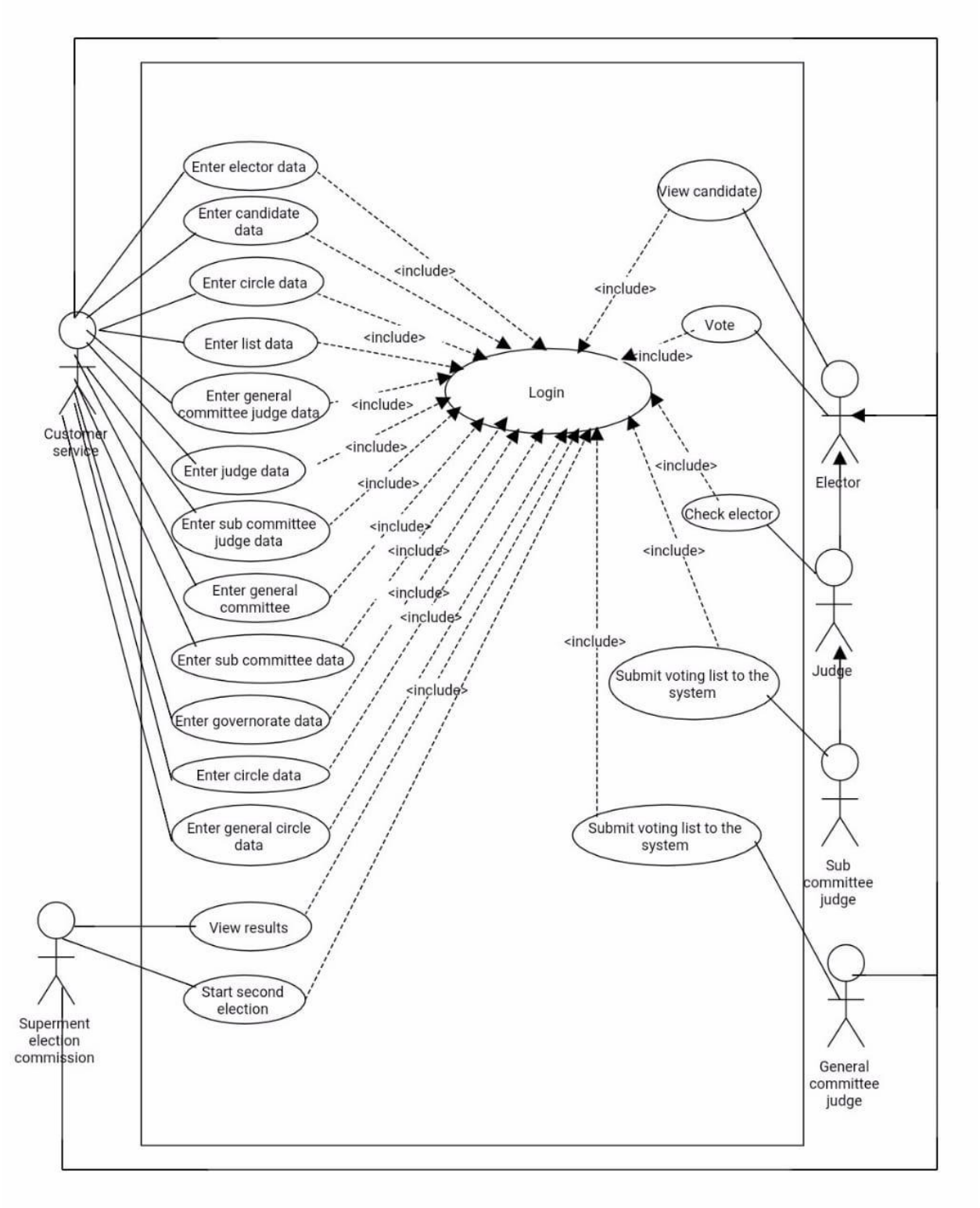

Figure 19:Use case Diagram

ii) Use case description:

Use case name	Description	Actors	condition
login	Allow user to enter data of a valid account and entering the application	Electors, customer service, judge, Sub-committee chair, Chairman of general committee, Supreme election commission.	Just open the application.
Enter elector data	Customer service enters data of electors(name, national ID, circle, committee number and subcommittee number).	Customer service	Login to system.
Enter judge data	Customer service enters data of judges (name, national ID, circle, committee number and subcommittee number, work in committee, work in subcommittee).	Customer service	Login to system.
Enter candidate data	Customer service enters data of candidates (job, description, symbol, age, party, name, national ID, circle, committee number and subcommittee number).	Customer service	Login to system.
Enter general committee judge data	Customer service enters data of general committee judge data(name, national ID, circle, committee number and subcommittee number, work in committee).	Customer service	Login to system.
Enter sub-committee judge data	Customer service enters data of sub-committee judge data (name, national ID, circle, committee number and subcommittee number, work in committee, work in subcommittee).	Customer service	Login to system.

Enter list data	Customer service entering data of list(list symbol and list name).	Customer service	Login to system.
Vote	Allow all users to vote for candidates and lists	Electors	Login to system.
View Candidate	Allow elector to see candidates exist in his circle and know information about them	Electors	Login to system
Check voter's and voter's list	Allow judge to check if elector has the right to vote or not.	Judge	Login to system.
Send voter's list to general committee	Sub-committee chair send voter's list to general committee to confirm it.	Sub-committee judge	Login to system.
Send voter's list to supreme election commission	Chairman of general committee send voter's list to supreme election commission to confirm it.	Chairman of general committee	Login to system.
View results	Supreme election commission only have the right to view and announcement the final result.	Supreme election commission	Login to system.

Table 4: Use Case Description

Chapter 5: System Design

In this chapter we will walk through the sequence and class diagrams of the system. We will also have a look on the application

5.1 System sequence diagram:

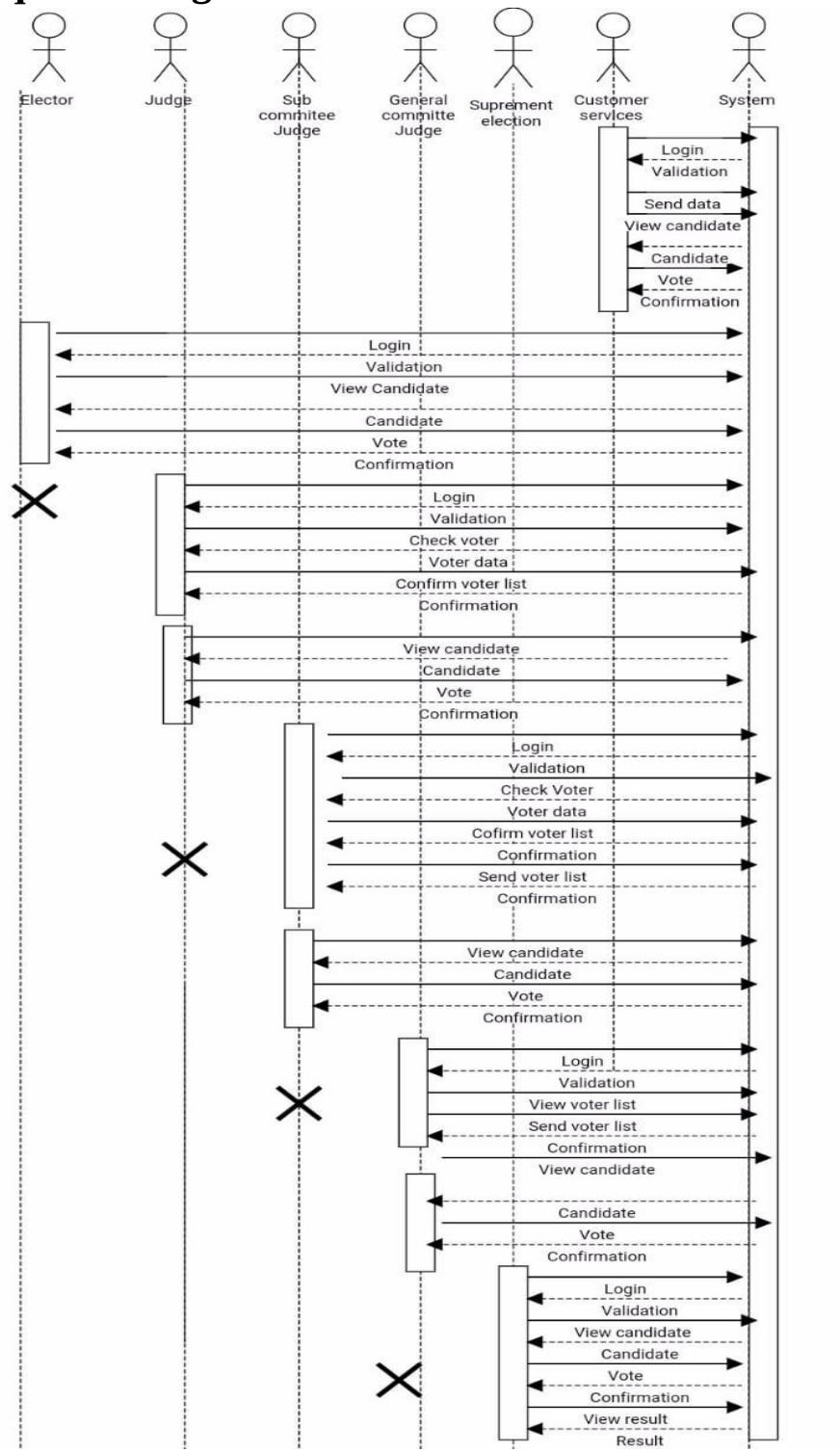

Figure 20:Sequence diagram

Sequence diagram description:

- Electors: Send login request to system, system will response by validation, then electors can view candidates and lists to vote.

- Judge: sends login request to system, system will response by validation, then judge can view candidates and lists to vote.

- Subcommittee judge: Sends login request to system, system will response by validation, then can check voter, confirm voter list and sent voter list.

- General committee judge: Sends login request to system, system will response by validation, then can view voter list and candidate, can vote and send voter list with confirmation.

- Super election committee: sends login request to system, system will response by validation, then can view result.

- Customer service: sends login request to system, system will response by validation, then he can send all data to system.

5.2 Class diagram:

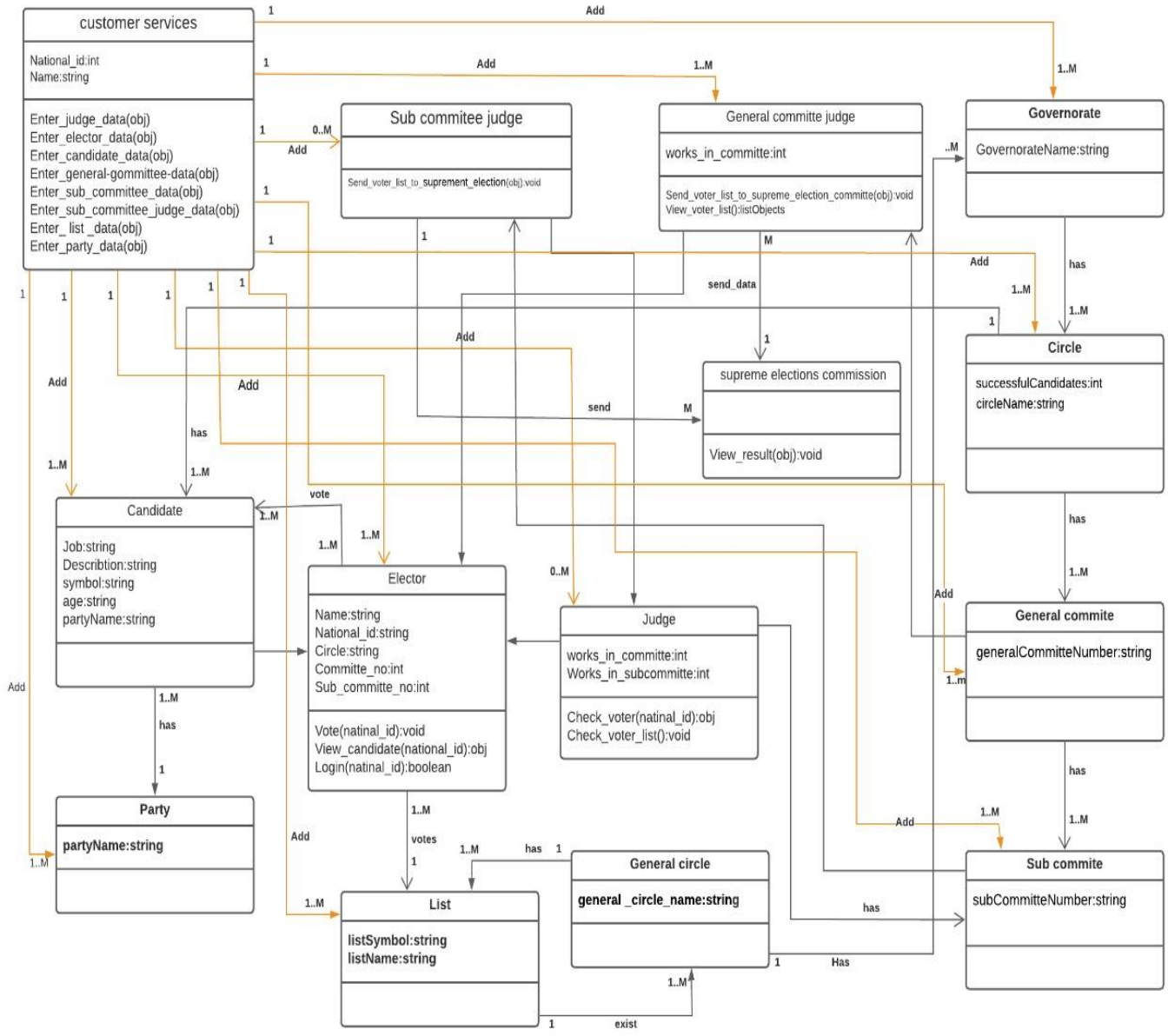

Figure 21:Class diagram

Class diagram description:

Customer service: Can add candidate, elector, judge and subcommittee judge, general committee judge, general circle, governorate, circle, general committee, subcommittee, list and party.

Subcommittee judge: Sends data to general committee judge.

Governorate: Has one or many circle at least one.

Circle: Has one or many general committees.

General committee: has one or many subcommittee (at least one).

Elector: Votes for one list, one or many candidate.

5.3 Application Figures:

We will view the system in perspective of each entity that enters the system.

1) First login and login pages

Figure 22: first login page

Figure 23:Second login page

2) Customer service

1.

Figure 24:home page

2.

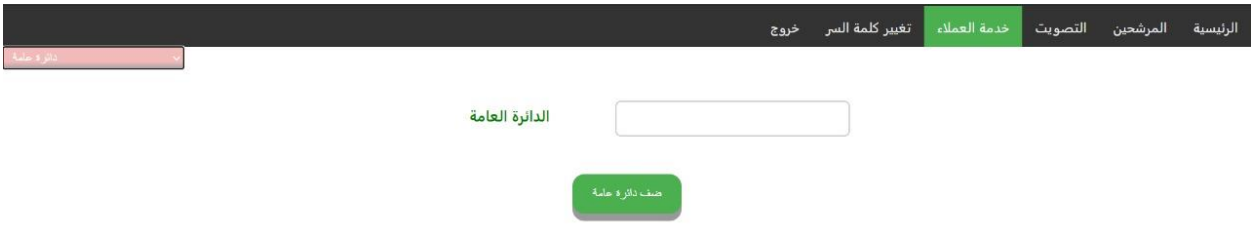

Figure 25:create general circle

3.

Figure 26:create governorate

4.

Figure 27:create circle

5.

Figure 28:create general committee

6.

Figure 29:create Subcommittee

7.

Figure 30:create candidate

8.

Figure 31:create customer service

9.

Figure 32:create elector

10.

Figure 33:create general committee judge

11.

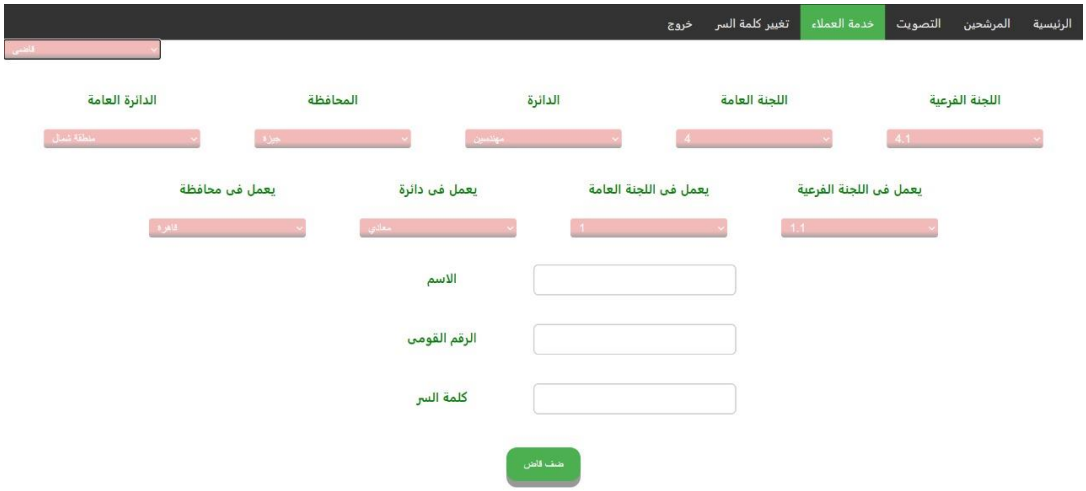

Figure 34:create judge

12.

Figure 35:create List

13.

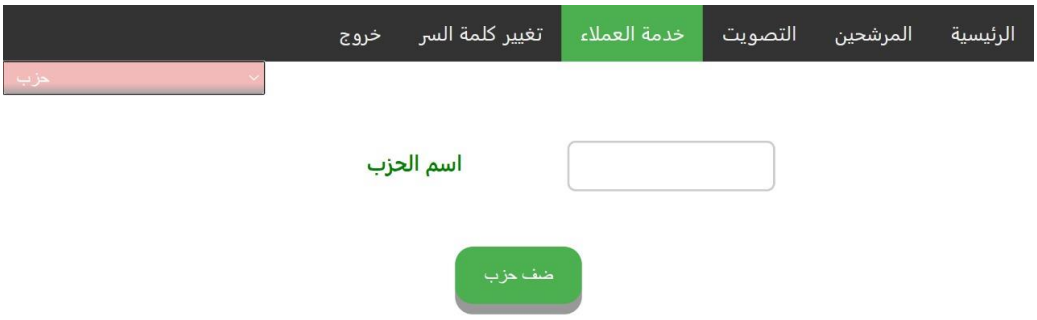

Figure 36:create party

14.

Figure 37:create chairman of Supreme Electoral Commission

15.

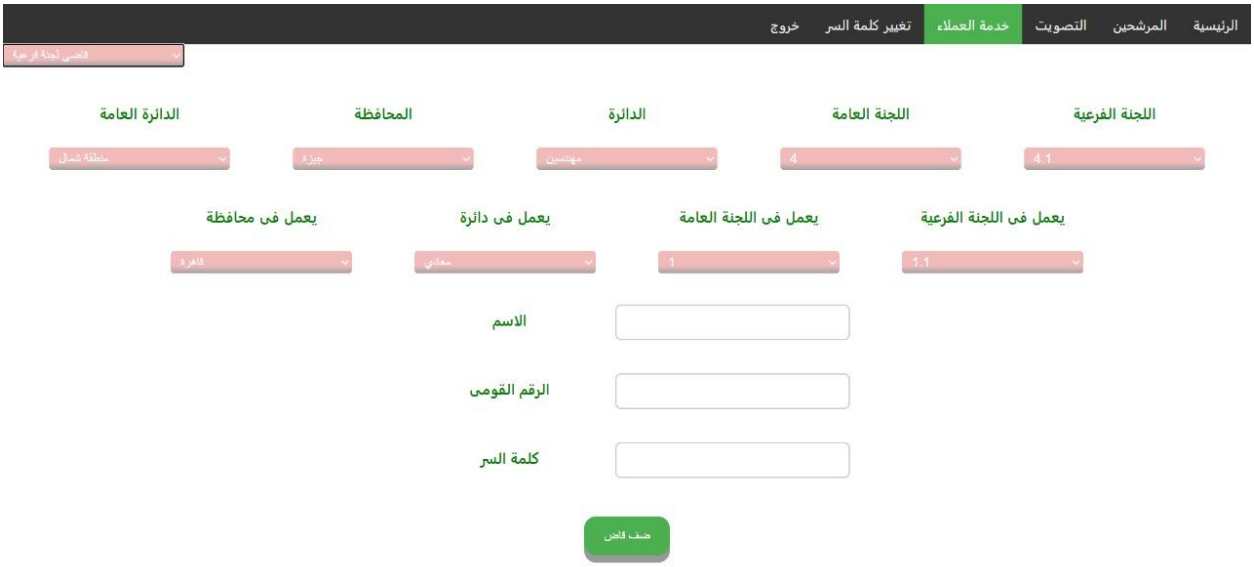

Figure 38:create subcommittee judge

16.

Figure 39:select candidate for voting

17.

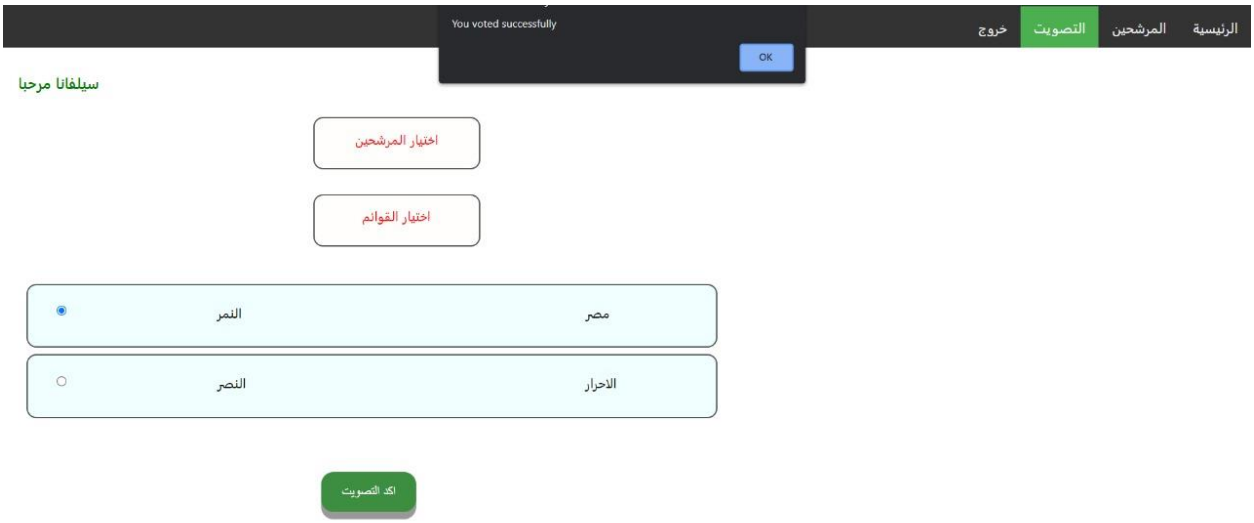

Figure 40:submit voting (voted successfully)

18.

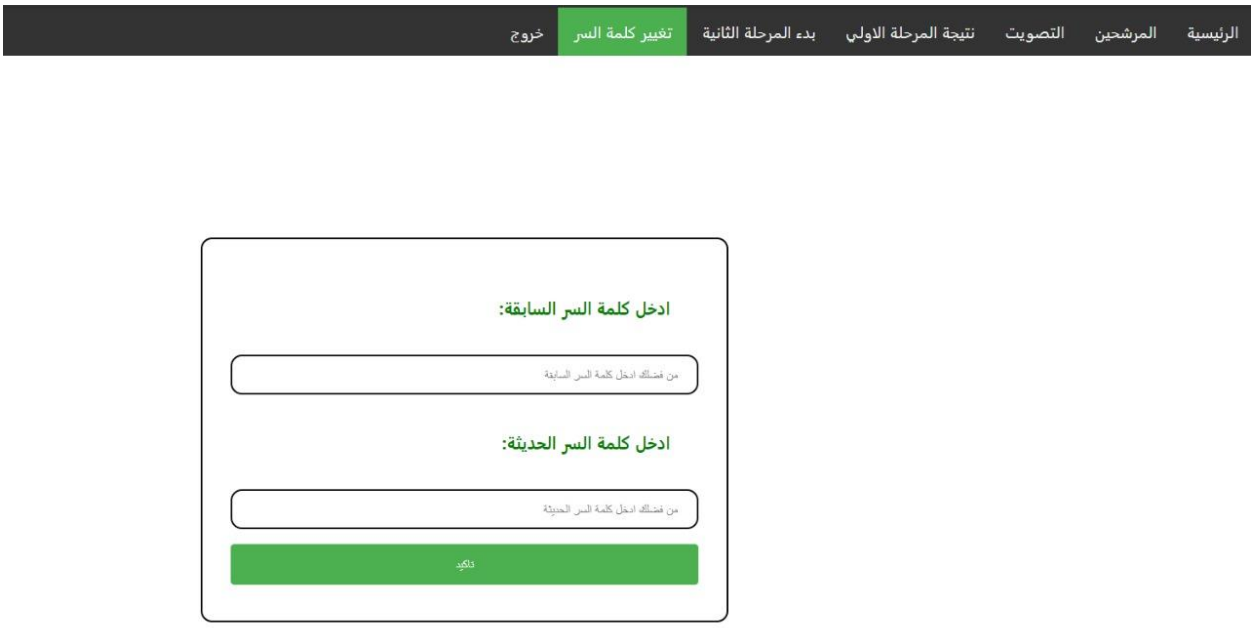

Figure 41:change password

3) Judge

1.

Figure 42:searching for electors by nationalID

2.

Figure 43:result of searching by nationalId of another subcommittee

4) General committee judge

1.

Figure 44:view all sub committees

2.

Figure 45:select subcommittee

3.

Figure 46:electors in selected subcommittee

4.

Figure 47:after submitting

5) Subcommittee judge

1.

Figure 48:view electros

2.

Figure 49:electors in subcommittee

3.

Figure 50:after submitting

6) Elector

1.

Figure 51:login page for electors and subcommittee judge

2.

Figure 52:electors home page

3.

Figure 53:selecting candidate for vote

4.

Figure 54:select list for voting

5.

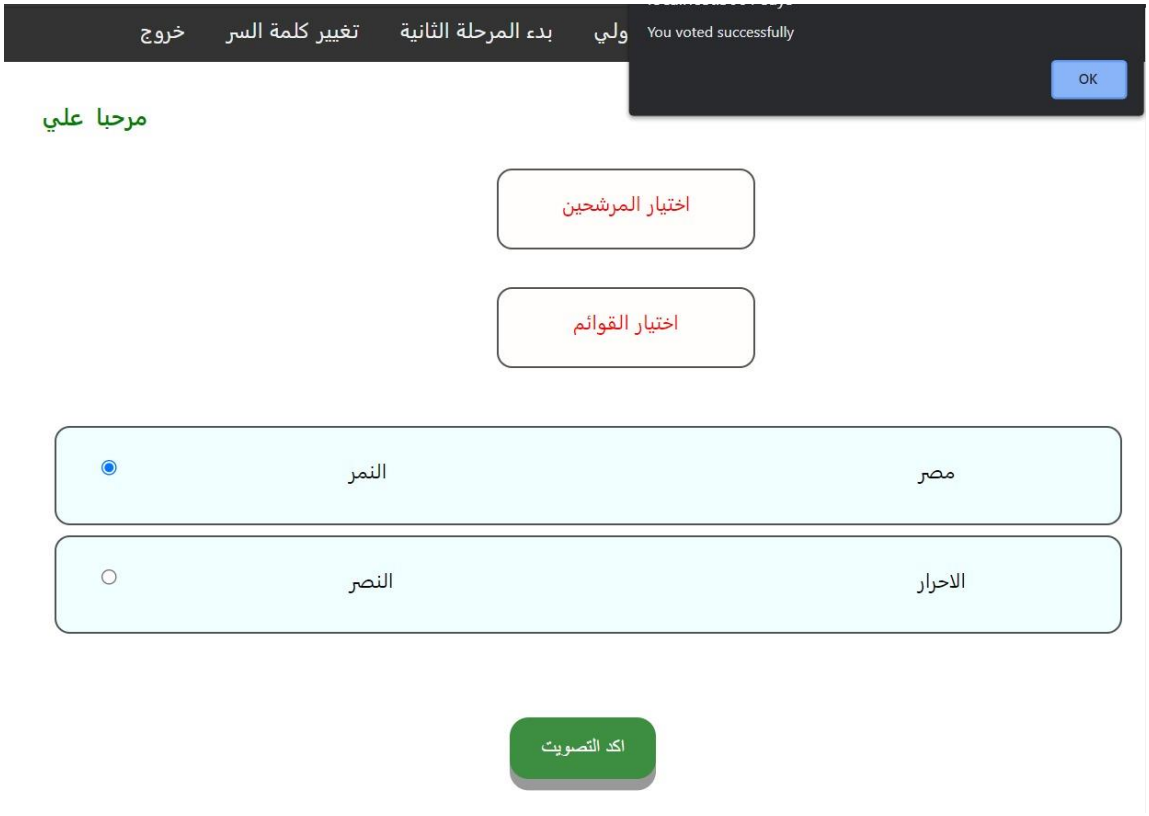

Figure 55:submit vote

6.

Figure 56: candidates in elector circle

7.

Figure 57: candidate information

7) Chairman of Supreme Electoral Commission

1.

Figure 58: failed to start second election

2.

Figure 59: candidates first election result

3.

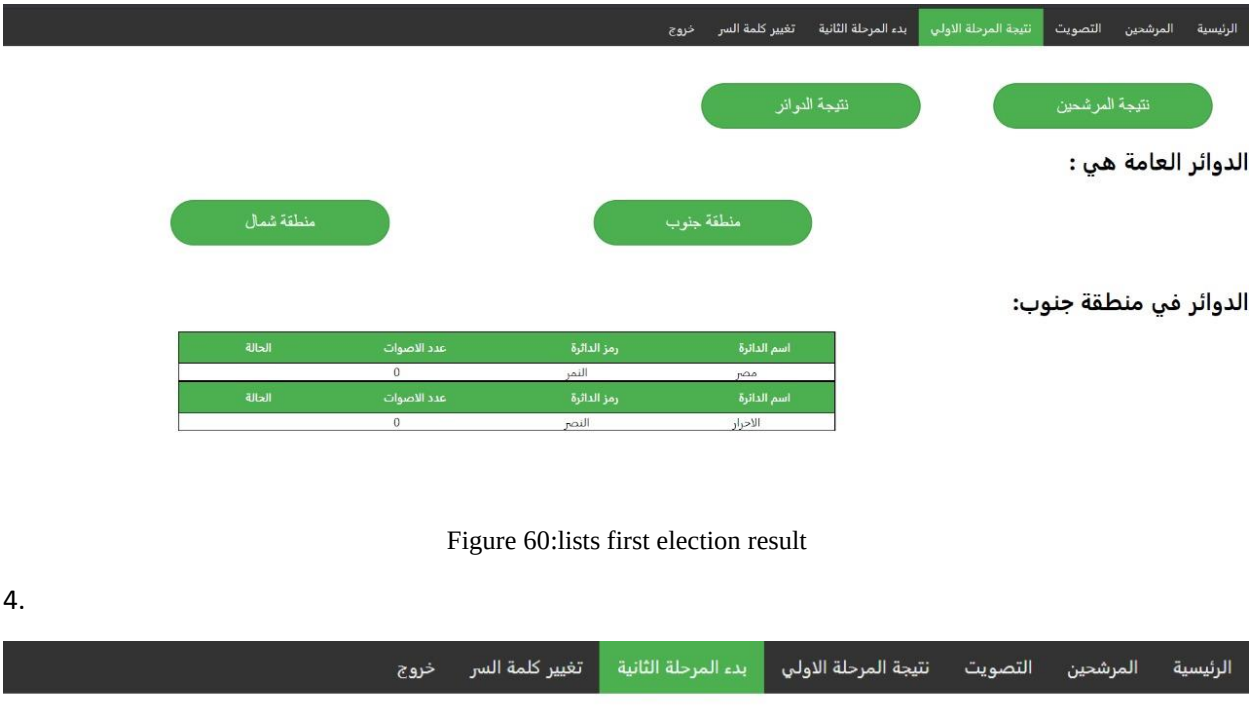

Figure 60:lists first election result

4.

لقد بدأت المرحلة الثانية بنجاح

Figure 61: start second election

Chapter 6: Testing and Validation

In this chapter we will walk through the testing phase and how we enforced an important part of software lifecycle in the application.

6.1 Manual testing

Project name: Digital transformation of Egyptian parliamentary election

Unit to test: 1) negative First Login page.

Steps to be executed	Test data	Expected result	Actual result	Testing result
1. Entering a valid national id and valid password specific to elector only. 2. click on login button.	-National id is 14 numbers. -Password of 8 or more characters.	Login fail	Error message: enter valid data	**pass**
1. Entering invalid national id and valid password. 2. click on login button	-National id containing letters. -Password of 8 or more characters.	Login fail	Error message: enter valid data	**pass**
1. Entering valid national id and invalid password. 2. click on login button	-National id is 14 number. -Password of less than 8 characters.	Login fail	Error message: enter valid data	**pass**

Precondition: lunch the application to login and entering wrong data (only for Chairman of Supreme Electoral Commission, customer service, General-committee judges, sub-committee judges and judges)

Table 5: negative First Login page

Unit to test: 2) First Login page.

Precondition: lunch the application to login by entering valid data (only for chairman of Supreme Electoral Commission, customer service, General-committee judges, sub-committee judges and judges)

Steps to be executed	Test data	Expected result	Actual result	Testing result

1. Entering a valid national id and valid password proper to customer service. 2. click on login button.	-National id is 14 number for a customer service. -Password of 8 or more characters.	-Going to customer service destination (page).	customer service page	**pass**
1. Entering a valid national id and valid password proper to chairman of Supreme Electoral Commission. 2. click on login button	-National id is 14 number for a chairman of Supreme Electoral Commission. -Password of 8 or more characters.	-Going to chairman of Supreme Electoral Commission destination (page).	chairman of Supreme Electoral Commission page.	**pass**
1. Entering a valid national id and valid password proper to General-committee judge. 2. click on login button.	-National id is 14 number for a General-committee judge. -Password of 8 or more characters.	-Going to General-committee judge destination (page).	General-committee judge page	**pass**
1. Entering a valid national id and valid password proper to Sub-committee judge. 2. click on login button.	-National id is 14 number for a Sub-committee judge. -Password of 8 or more characters.	going to login page	login page appear	**pass**
1. Entering a valid national id and valid password proper to judge. 2. click on login button.	-National id is 14 number for a judge. -Password of 8 or more characters.	-Going to judge destination (page).	judge page	**pass**

Table 6: First Login page

Unit to test: 3) Verify functions of login page.

Precondition: lunch the application, subcommittee judge login at first login page by valid national id and password.

Steps to be executed	Test data	expected result	Actual result	testing result
-Enter the same national id of subcommittee judge	-Enter national id of 14 number click login	subcommittee judge page will appear	-Home page of	**pass**

-click login			subcommittee judge	
-Enter national id of elector in the same subcommittee	-Enter national id of 14 number click login	-Electors page will appear	-Elector home page	**pass**
-Enter national id of elector in another subcommittee	-Enter national id of 14 number click login	**process Error**	-Enter valid data	**pass**

Table 7: Verify functions of login page

Unit to test: 4) Verify functions of customer services (**must** adding at least one of general circle, governorate, circle, general committee and sub-committee respectively).

Precondition: lunch the application and login by entering valid national id of customer services.

Steps to be executed	Test data	Expected result	Actual result	Testing result
-Customer service trying to add General circle -Write a new general circle name (string).	-Click on General circle field. -Name of general circle as (شمال)	**Done**	Save general circle With response (200)	**pass**
-Customer service trying to add governorate - Select general circle -Write a new governorate name (string)	-Click on governorate field. -Name of governorate as (القاهرة).	**Done**	Save governorate With response (200)	**pass**
-Customer service trying to add circle -select general circle -select governorate write a new circle name	Click on circle field. name of circle as (المعادى)	**Done**	Save circle With response (200)	**pass**
-Customer service trying to add general committee -select general circle -select governorate -select circle	Click on general committee field. number of general committee as (1)	**Done**	Save general committee With response (200)	**pass**

-write a unique number of general committee.				
-Customer service trying to add sub-committee -select general circle -select governorate -select circle -select general committee -write a new number of sub-committee.	Click on sub-committee field. number of sub-committee as (1)	**Done**	Save sub-committee With response (200)	**pass**
-Customer service trying to add sub-committee -select general circle -select governorate -select circle -select general committee -write an exist number of sub-committee on different general committee	Click on general committee field. number of general committee as (2)	**Done**	Save sub-committee With response (200)	**pass**
-Customer service trying to add party -enter new party name	Click on party name party name as(الوفد)	**Done**	Save party With response (200)	**pass**
-Customer service trying to add list -enter new list symbol -enter new list name -select general circle	Click on list filed symbol as (النسر) name as (مصر) general circle (North)	**Done**	Save list With response (200)	**pass**
-Customer service trying to add elector. -select general circle -select governorate -select circle -select general committee -select sub-committee -enter name (string of max length 50) -enter unique national id of 14 number	-Click elector field -add name as (محمد علی احمد) -add national id of 14 number (12345678912345)	**Done**	Save elector With response (200)	**pass**

-customer service trying to add candidate. -select general circle, governorate, circle, party, general committee and sub-committee -enter name -enter unique national id of 14 number -enter job -enter description -enter unique symbol -enter image	-Click candidate field -add name -add national id of 14 number (12345671234567) -add job as (محامى) -add description -add unique symbol as (البمر) -add image -click on add button	**Done**	Save candidate as elector and candidate With response (200)	**pass**
-customer service trying to add chairman of Supreme Electoral Commission. -select general circle, governorate, circle, general committee and sub-committee -enter name -enter unique national id of 14 number -enter password	Click on create chairman of Supreme Electoral Commission button after entering data.	**Done**	Save chairman of Supreme Electoral Commission as elector and chairman of Supreme Electoral Commission With response (200)	**pass**
-customer service trying to add judge. -select general circle, governorate, circle, general committee and sub-committee -enter name -enter unique national id -enter work-in-governorate -enter work-in-circle	-Click judge field -add name as (محمود ممدوح جابر) -add national id of 14 number (12345671234777) -add governorate worked in. -add circle worked in. -add general committee worked in.	**Done**	Save judge as elector and judge With response (200)	**pass**

-enter work-in-general committee. -enter work-in-sub-committee -enter password of min length 8	-add sub-committee worked in. -add password			
-customer service trying to add subcommittee judge. -select general circle, governorate, circle, general committee and sub-committee -enter name -enter unique national id -enter work-in-governorate -enter work-in-circle -enter work-in-general committee. -enter work-in-sub-committee -enter password	-Click subcommittee judge field -add name as (سلمى ياسر) -add national id of 14 number (12345671232277) -add governorate worked in. -add circle worked in. -add general committee worked in. -add sub-committee worked in. -add password	**Done**	Save subcommittee judge as elector and subcommittee judge With response (200)	**pass**
-customer service trying to add general committee judge. -select general circle, governorate, circle, general committee and sub-committee -enter name -enter unique national id -enter work-in-governorate -enter work-in-circle -enter work-in-general committee. -enter work-in-sub-committee	-Click general committee judge field -add name as (احمد مجدى) -add national id of 14 number -add governorate worked in. -add circle worked in. -add general committee worked in. -add sub-committee worked in. -add password	**Done**	Save general committee judge as elector and general committee judge With response (200)	**pass**

-enter password				
Customer services trying to add a customer service information: 1. Entering data with unique national id of 14 number.	-National id of 14 number. -press add button.	**Done (save customer service as elector and customer service.**	Successful adding with response (200)	**pass**
-Customer service trying to see candidates on his circle -click on candidates field	-click on candidates field	**expect to show all candidates of his circle to know them**	candidates page appear of all candidates in his circle	**pass**
-Customer service trying to know details of any of candidate. -click on any candidate need to know more details about him	click on candidates field click on the candidates to see their details	**expect to show more details**	candidate details appear as description, job, image and age	**pass**
-Customer service trying to make vote after viewing candidates. -by clicking on voting field -select number of candidates required to vote for them in his circle. -then click to select list -click on submit vote to confirm his voting	-click on voting field -select candidate -select list -submit vote	**voting success**	message: you voted successfully	**pass**
-Customer service try to vote again	-click on voting field	**process error**	Error message: You voted before	**pass**
-Customer service try to change his own password -click on change password field -enter old password	-entering old password -entering new password	**done and logout of system to try to login in by new password**	Password successfully changed. First login page appear.	**pass**

-enter new password of length 8 or more -click change password button.				
-Customer service to return to home page	-click on home field	**home page appear**	return to home page	**pass**
customer service trying to log out	Click on log out field	**transfer to first login page again**	first login page is appear	**pass**

Table 8:Verify functions of customer services

Unit to test: 5) Verify functions of judges

Precondition: lunch the application and login by entering valid national id of judges.

Steps to be executed	Test data	Expected result	Actual result	Testing result
Judge trying to make vote after viewing candidates. -by clicking on voting field -select number of candidates required to vote -then click to select list -click on submit vote to confirm his voting	-click on voting field -select candidate -select list -submit vote	**voting success**	message: you voted successfully	**pass**
Judge try to search for a national id of elector. -click on search for national id -Enter national id need to search for (in his sub-committee).	-click on search for national id -Enter valid national id of 14 number as (12305678501222).	**expect to show all information of the elector**	all information appear as (name, national id, governorate, circle, general committee, sub-committee and if he vote or not)	**pass**

Judge try to search for a national id of elector (not in his sub-committee). -click on search for national id -Enter national id need to search for (not in his sub-committee).	-click on search for national id -Enter valid national id of 14 number as (12305678501112).	**process error**	السجل غير موجود	**pass**
-Judge trying to log out	Click on log out field	**transfer to first login page again**	first login page is appear	**pass**

Table 9: Verify functions of judges

Unit to test: 6) Verify functions of general committee judges.

Precondition: lunch the application and login by entering valid national id of general committee judge.

Steps to be executed	Test data	Expected result	Actual result	Testing result
-General committee judge trying to make vote after viewing candidates. -by clicking on voting field -select number of candidates required to vote -then click to select list -click on submit vote to confirm his voting	-click on voting field -select candidate -select list -submit vote	**voting success**	message: you voted successfully	**pass**
-General committee judge trying to show state of electors in his general committee (if they voted or not) and submit (confirm) for them	-Click on show electors field -click on number of sub-committee -click submit	**process complete**	تم التاكيد، شكرا	**pass**

-click on show electors field -choose sub-committee need to show -and then click on submit to confirm				
-General committee judge try to change his own password -click on change password field -enter old password in old password field -enter new password of length more than 9 -click change password button.	-entering old password -entering new password	**done and logout of system to try to login in by new password**	Password successfully changed. First login page appear.	**pass**
-General committee judge try to change his own password -click on change password field -enter old password in old password field -enter new password of length less than 8 -click change password button.	-entering old password -entering new password	**process error**	error message: Old password is not correct or new password is too short	**pass**
-General committee judge try trying to log out	Click on log out field	**transfer to first login page again**	first login page is appear	**pass**

Table 10:Verify functions of general committee judges

Unit to test: 7) Verify functions of sub-committee judges.

Precondition: lunch the application and login by entering valid national id of sub-committee judge and password then enter the same id in login page.

Steps to be executed	Test data	Expected result	Actual result	Testing result
-Subcommittee judge trying to make vote after viewing candidates. -by clicking on voting field -select number of candidates required to vote for them in his circle. -then click to select list (only one list) -click on submit vote to confirm his voting	-click on voting field -select candidate -select list -submit vote	**voting success**	message: you voted successfully	**pass**
-Subcommittee judge try to search for a national id of elector. -click on search for national id -Enter national id need to search for (in his sub-committee).	-click on search for national id -Enter valid national id of 14 number as (12305678501222).	**expect to show all information of the elector**	all information appear as (name, national id, governorate, circle, general committee, sub-committee and if he vote or not)	**pass**
-Subcommittee judge try to search for a national id of elector. -click on search for national id -Enter national id need to search for (not in his sub-committee).	-click on search for national id -Enter valid national id of 14 number as (12305678501112).	**process error**	سجل غير موجود	**pass**
-Subcommittee judge trying to show state of electors in his subcommittee (if they voted or not) and submit (confirm) for them	-Click on show electors field -click submit	**process complete**	تم التأكيد، شكرا	**pass**

-click on show electors field -and then click on submit to confirm				
-Subcommittee judge trying to log out	Click on log out field	**transfer to login page again**	login page is appear	**pass**

Table 11:Verify functions of sub-committee judges

Unit to test: 8) Verify functions of Chairman of Supreme Electoral Commission judges.

Precondition: lunch the application and login by entering valid national id of chairman of Supreme Electoral Commission judge and password.

Steps to be executed	Test data	Expected result	Actual result	Testing result
-Chairman of Supreme Electoral Commission judge trying to make vote after viewing candidates. -by clicking on voting field -select number of candidates required to vote for them in his circle. -select list -submit vote to confirm his voting	-click on voting field -select candidate -select list -submit vote	**voting success**	message: you voted successfully	**pass**
-Chairman of Supreme Electoral Commission try to start second election before show first election result	-click on start second election field	**process error**	من فضلك اعرض نتيجة المرحلة الاولى للمرشحين و الدوائر.	**pass**

-start it by click on start second election field				
-Chairman of Supreme Electoral Commission judge trying to know the first election result -Click on first election result field -choose candidate result -choose governorate -choose circle to know the result to announce it.	-click on first result election field -select governorate -select circle	process done	candidate result in the selected circle is appear	**pass**
-choose lists result this try -select general circle to the result to announce it.	-click on lists result -select general circle	process done	lists result in the selected general circle is appear	**pass**
-to start the second election chairman of Supreme Electoral Commission must start it by click on start second election field	-click on start second election field	process done	لقد بدأت المرحلة الثانية بنجاح	**pass**
-Chairman of Supreme Electoral Commission judge try to change his own password -click on change password field -enter old password in old password field -enter new password of length more than 9 -click change password button.	-entering old password -entering new password	**done and logout of system to try to login in by new password**	Password successfully changed. First login page appear.	**pass**
-Chairman of Supreme Electoral Commission judge trying to log out	Click on log out field	**transfer to first login page again**	first login page is appear	**pass**

Table 12:Verify functions of Chairman of Supreme Electoral Commission judges

Unit to test: 9) Verify functions of electors.

Precondition: lunch the application and login by entering valid national id of sub-committee judge and password then enter the national id of elector on same subcommittee.

Steps to be executed	Test data	expected result	Actual result	testing result
-Elector trying to make vote after viewing candidates. -by clicking on voting field -select candidates -select list (only one list) -click on submit vote to confirm his voting	-click on voting field -select candidate -select list -submit vote	**voting success**	message: you voted successfully	**pass**
-Elector trying to vote but select number of candidate less than required to success in his circle then select list click on submit vote	-click on voting field -select less number of candidate -select list -submit vote	**process error**	can't submit his vote	**pass**
-Elector trying to vote again	-click on voting field	**process error**	Error message: You voted before	**pass**
-Elector try to vote without select list	-click on voting field -select candidate -submit vote	**process error**	can't submit his vote	**pass**
-Elector try to return to home page	-click on home field	**home page appear**	return to home page	**pass**
-Elector trying to log out	Click on log out field	**transfer to login page again**	login page is appear	**pass**

Table 13:Verify functions of electors

Unit to test: 10) Verify voting functions in second election.

Precondition: lunch the application login to vote by entering valid data.

Steps to be executed	Test data	expected result	Actual result	testing result
-elector trying to view candidates in second election -click on candidate field	click on candidate field	candidates who are in second election in his circle will appear	candidates of second election appear	**pass**
-Elector trying to make vote -by clicking on voting field -select number of candidates -select list -click on submit vote to confirm his voting	-click on voting field -select candidate -select list -submit vote	**voting success**	message: you voted successfully	**pass**

Table 14:Verify voting functions in second election

Chapter 7: Conclusions

At the end we have been able to make a complete election system for our government that we can rely on in the future completely, as we resolved most problems happening in the election process which was done by paper previously, it can be automated to save time, money and effort for all participating members as electors and the administrators as judges and others by making it much easier with just a button press. Also, the problem of suspicions in the Egyptian society that there are a lot of people who ask about the truthfulness of results was solved by encrypting all data in the system.

And finally, many services are now easier and more convenient to facilitate the election process for all participating members as electors, judges and customer services, through the digital transformation of Egyptian parliamentary election which will help in save their time.

References

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