University of Guyana

Faculty of Natural Sciences,
Department of Computer Science.

Course Name: Software Engineering I
Course Code: CSE 2101
Lecturer: Alicia Layne

Semester Project
Submission Three (3), System Design

Group members:
Waynetta Naughton USI: 1039889
Carita Morris USI: 1040410
Kristeen Chase USI: 1039656
Angelique Browne USI: 1035438
Bhudram Singh USI: 1040381
Teyana Shivsankar USI: 1034534
Rokaylia Thomas USI: 1041560

December 16, 2022

Table of Contents

Context Diagram 3

Use Case Model 4

Sequence Diagram 9

Class Diagram 11

- Overall Class Diagram 11
- A Closer Look at the Classes 12
  1. Candidate / Political Party 12
  2. Vote 12
  3. Voter 13
  4. IT Administrator 14
  5. IT Specialist 14
  6. GECOM 15
  7. File 15
  8. Candidate Files 15
  9. Registered Voter File 15

Activity Diagram 17

System Architectural Design 19

Member Contribution Report 27

References 28

Context Diagram

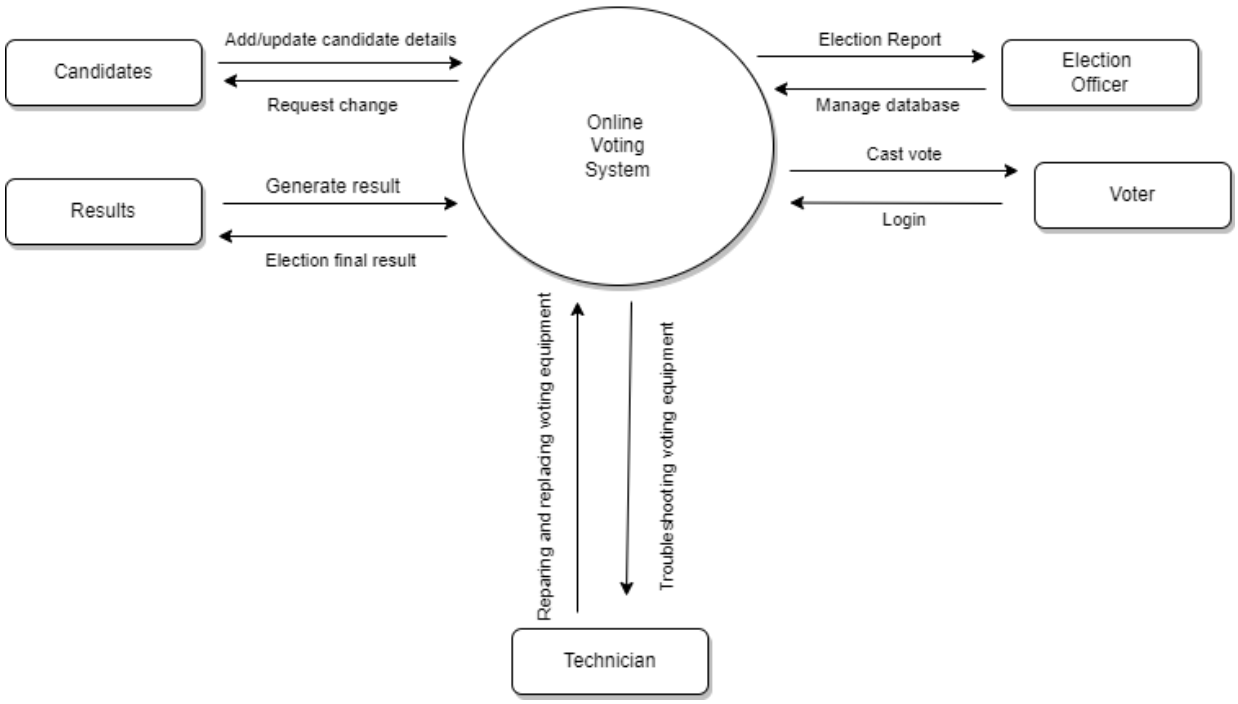


Figure 1: Context Level depicting the Structure of the proposed Elections Management System

A context diagram shows the interrelationships between the things that make up a system's or a component's environment as well as the border between them. They don't go into the detailed ins and outs of the system. Instead, they map out an entire system in a way that's simple, clear, and easy to understand.The diagram above demonstrates a context system.

Systems and processes are represented as rounded-cornered squares, while external entities, data stores, and data flows are represented by squares.

Use Case Model

Figure 2: Use Case Model showing how the different users interact with the Elections Management System

Use Case Specification Tables

Use Case: Register	
Actors	IT Admin, Elections Authority, Voter
Description	Users enter their personal information into the system in order to be registered
Data	User's personal information (Some form of identification)
Stimulus	Command is issued by users and potential users
Response	User becomes a part of the system after authentication is given their specified roles/privileges

Use Case: View Party	
Actors	Voter
Description	Voters have the option to display the parties involved in the election.
Data	Details of the parties involved in the election
Stimulus	Command is issued by the voter
Response	The system displays parties involved in the election

Use Case: Cast Vote	
Actors	Voter
Description	Voter has the option to select/confirm/change the party/candidate they would like to vote for
Data	Party of choice selected by voter
Stimulus	Command is issued by voter
Response	When the voter is satisfied with their vote and has confirmed, the system will alert the user that the process has been successful

Use Case: Fix malfunction	
Actors	IT Specialist/Technician
Description	When an error in the system has been identified, the technician will either be noted by other actors or notice it on their own. They will further identify the origin of the error and make efforts to rectify the situation
Data	Error messages displayed by the system or changes in its designated functions
Stimulus	Technician will identify the origin of error and use appropriate measures to fix the problem
Response	The system, when fixed will run as it is specified to

Use Case: Guide IT Admin	
Actors	IT Specialist/Technician
Description	If there is any new fix to the system or the admin is having trouble navigating the system, the technician will dispense knowledge appropriately so that the admin will be able to understand
Data	New system features/fixes or areas in which the admin is not familiar with or does not understand
Stimulus	Technician will inform the admin when a feature is added or when the admin reaches out for assistance
Response	Technician will try to help the admin to understand their way around the system

Use Case: View and Publish Results	
Actors	Elections Authority
Description	At the end of the tallying process, the elections authority has the option to view results and publish them
Data	Results from the tallying process of votes cast
Stimulus	Command is issued by members of the elections authority

Response	Statistics that have resulted from the voting process (parties and total votes, spoilt votes, etc.)

Use Case: Generate Report	
Actors	Elections Authority
Description	At the end of the tallying process, result statistics will be generated. (eg. patterns identified)
Data	Results from the tallying process of votes cast
Stimulus	Command is issued by members of the elections authority
Response	Statistics that have resulted from the voting process in the form of reports will be generated and displayed

Use Case: Validate Voter's Information	
Actors	IT Administrator
Description	Admin will examine and validate voter's info to make sure that it is legitimate
Data	Information inputted by the potential voter
Stimulus	IT Admin will make sure that the information being inputted into the system is valid
Response	If the information is valid, the voter can successfully register, otherwise, they will be sent an error message

Use Case: Modify/Delete/Add Voter's Info	
Actors	IT Administrator
Description	Voters can request for edits to be made to their information and the admin can approve and make the necessary changes or there is the case where the admin has made some observations that would call for edits to be made.

Data	Information inputted by the potential voter
Stimulus	Command can only be issued by the Admin
Response	The necessary changes made will be successfully updated in the system

Use Case: Monitor System for Disruptions	
Actors	IT Administrator
Description	Admin will observe the system's runnings and make sure that there aren't any obstructions/hindrances to the processes
Data	System functions that are being executed
Stimulus	IT Admin will observe the system
Response	If the admin observes outside the specified functions, they will make the necessary changes or alert the appropriate personnel

Sequence Diagram

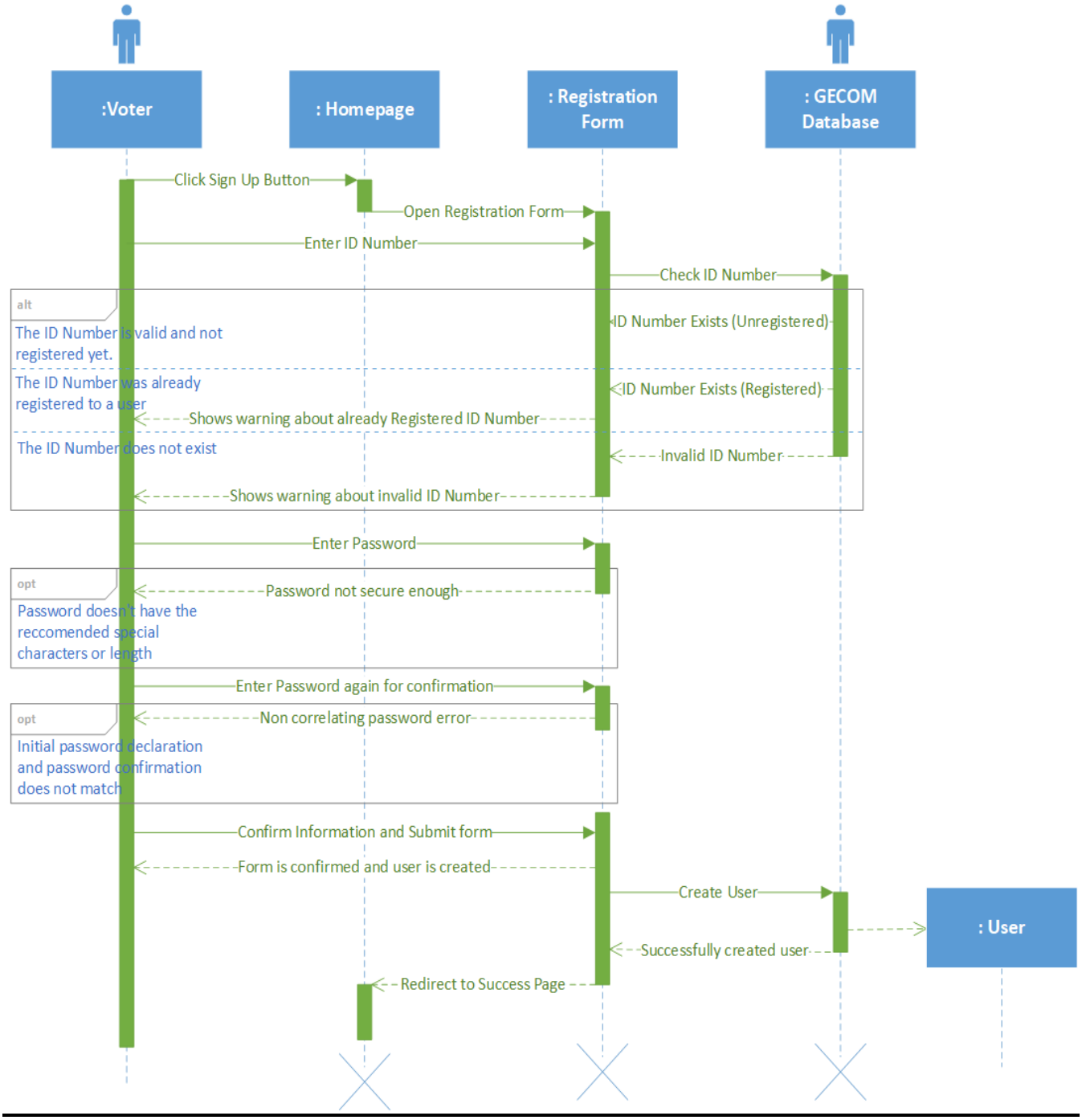


Figure 3: Sequence Diagram showing the voters' registration into the Elections Management System

A sequence diagram is a Unified Modelling Language (UML) diagram that depicts the sequence of messages between objects in an interaction (IBM, 2021). It is made up of a collection of items represented by lifelines, as well as the messages that they exchange over time throughout the interaction. Sequence diagrams can also illustrate the control structures that exist between objects. Lifelines are utilized in the figure above to depict the actors and objects, which are the voter, homepage, registration form, and GECOM database. Messages transmitted between the aforementioned entities reflect communication between them. The sequence diagram's main function is to depict the interactions between items in the order in which they occur.

The process of a voter enrolling into the system is depicted in our diagram, from pressing the sign-up button to the successful creation of a user. The solid arrow indicates a message which symbolizes the voters' input or activity in relation to the system. The arrow with dotted lines, on the other hand, symbolizes the return message, which is the system's response to the input. The boxes labeled alt and opt indicate that the interactions within them are either optional or alternative. Lastly, the broad solid green lines that follow the route of the lifeline reflect the time when the participant is carrying out an operation, and the x at the conclusion of certain lifelines signifies the timeline's destruction.

Class Diagram

Overall Class Diagram

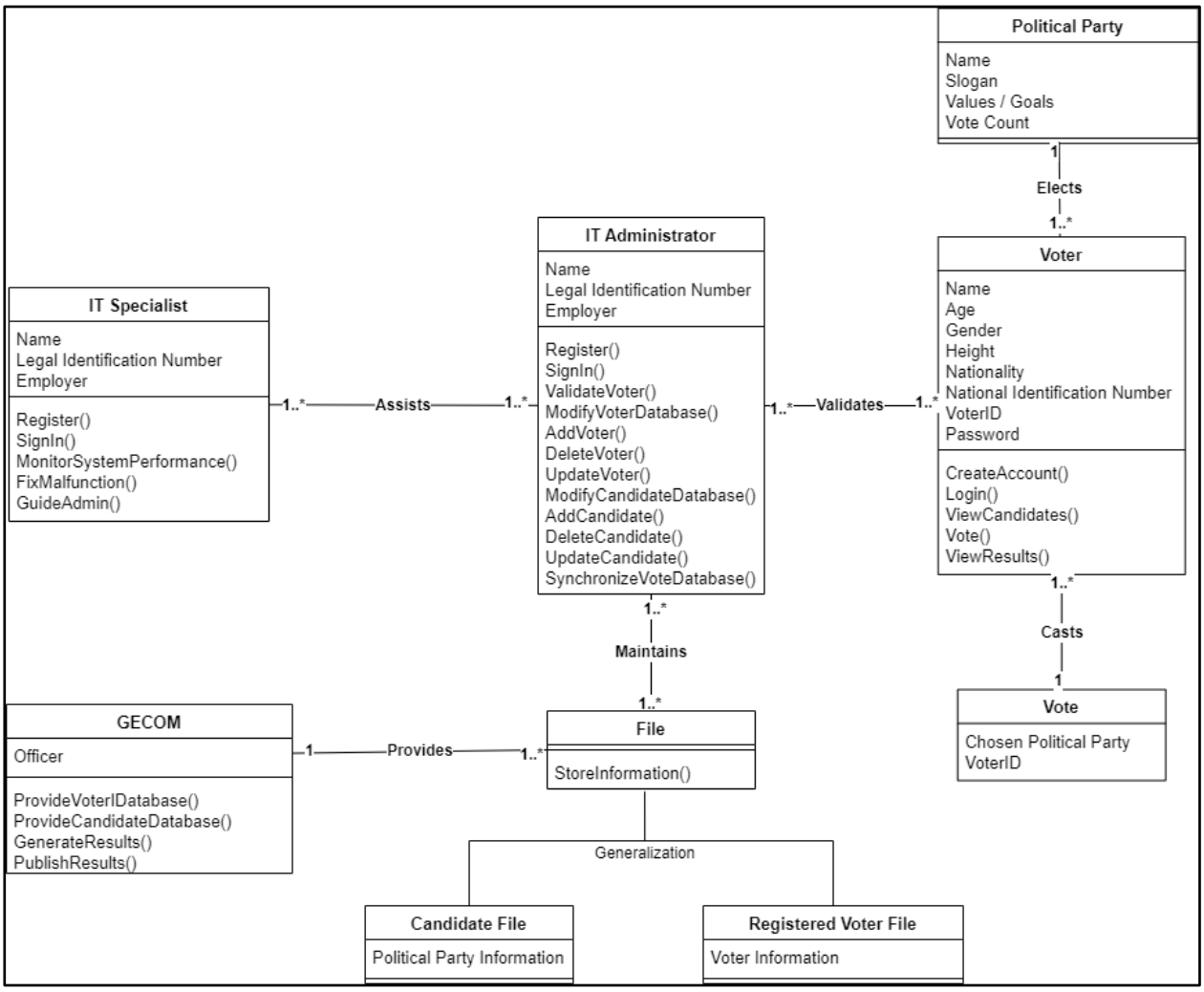
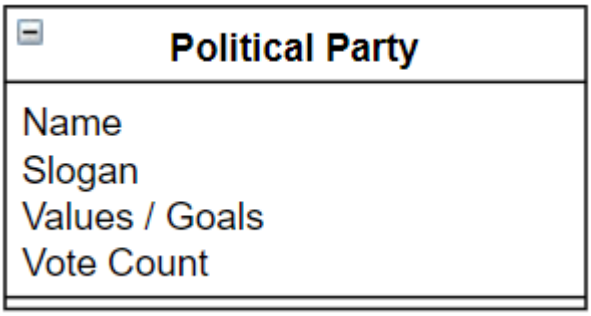


Figure 4: Class Diagram Showing the relationships among the different classes in the Elections Management System

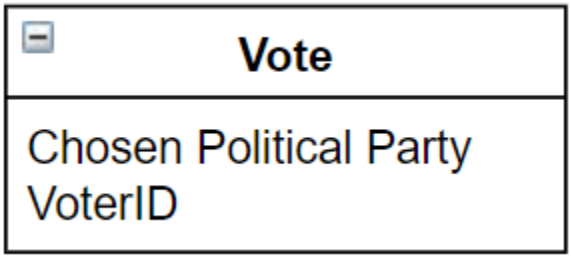
A Closer Look at the Classes

1. Candidate / Political Party



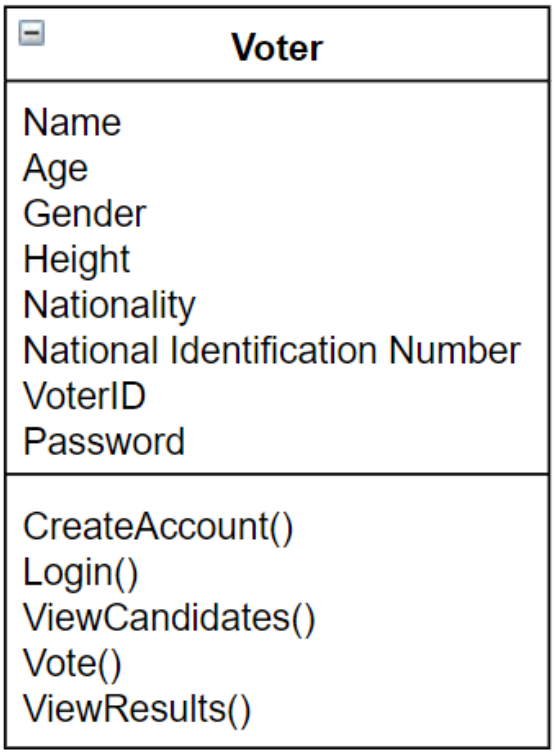
In the Local Government Elections, voters are electing a political party into power. The voters select this candidate based on their slogan, goals and values, as such, this information is important to the system and is depicted in the class above. The Political Party will also have a tally of votes associated with it that will determine whether or not they win the elections.

2. Vote



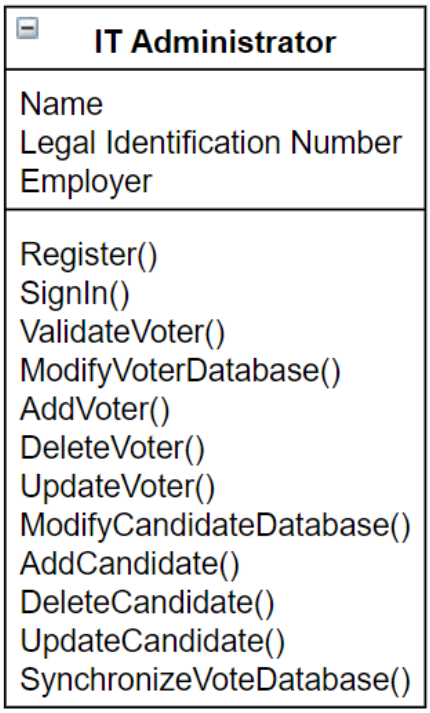
The vote class represents the votes cast by the user. Votes have two features, the Political party the user is voting for, and the VoterID.

3. Voter



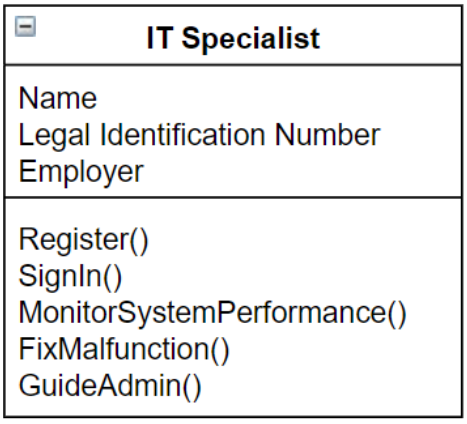
The voter class represents our voters, also known as our primary users. The attributes Name, Age, Gender, Height, Nationality and National Identification Number are provided by the voter during registration to aid the system in identifying the voter and verifying them as a legal voter. The VoterID is provided to the voter by the system and will aid them in logging in on election day. The voter can create an account, login, view the candidates (political parties participating in the elections) and view the results of the elections after the voting period has passed.

4. IT Administrator



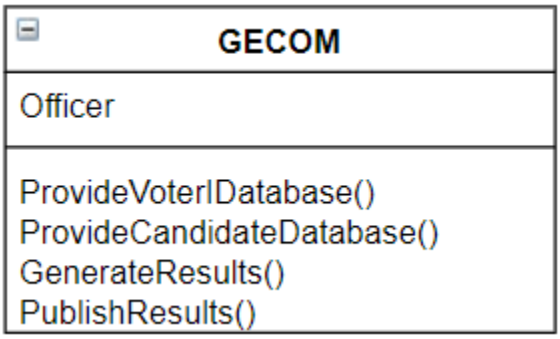
The IT Administrators are employees of GECOM and are tasked with managing the voter, candidate and vote Databases. They can add, remove and update the voter and candidate information, and are tasked with ensuring that the vote database accurately reflects the vote count.

5. IT Specialist



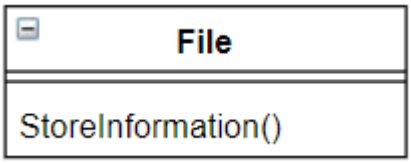
The IT Specialist is an employee of the developers. They are tasked with assisting the IT Administrators in their duties. Additionally, they monitor the system performance due to the high levels of traffic anticipated. They also monitor and fix any system malfunctions that may occur during the election period.

6. GECOM



The GECOM class is the class dedicated to the Guyana Elections Commission. They provide the voter and candidate information, and their primary point of contact will be the GECOM Office they elect. GECOM is also in charge of generating and publishing the results.

7. File

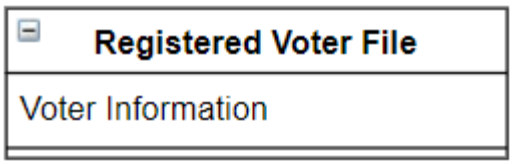


The File class is a generalization that refers to the three main databases that are to be maintained by the Moderators: Vote Database, Candidate Database and Registered Voter Database.

8. Candidate Files

The Candidate Files store the information provided by GECOM about those running for Local Government Elections.

9. Registered Voter File



The Registered Voter Files store the information provided by GECOM about the voters who registered to vote online.

Activity Diagram

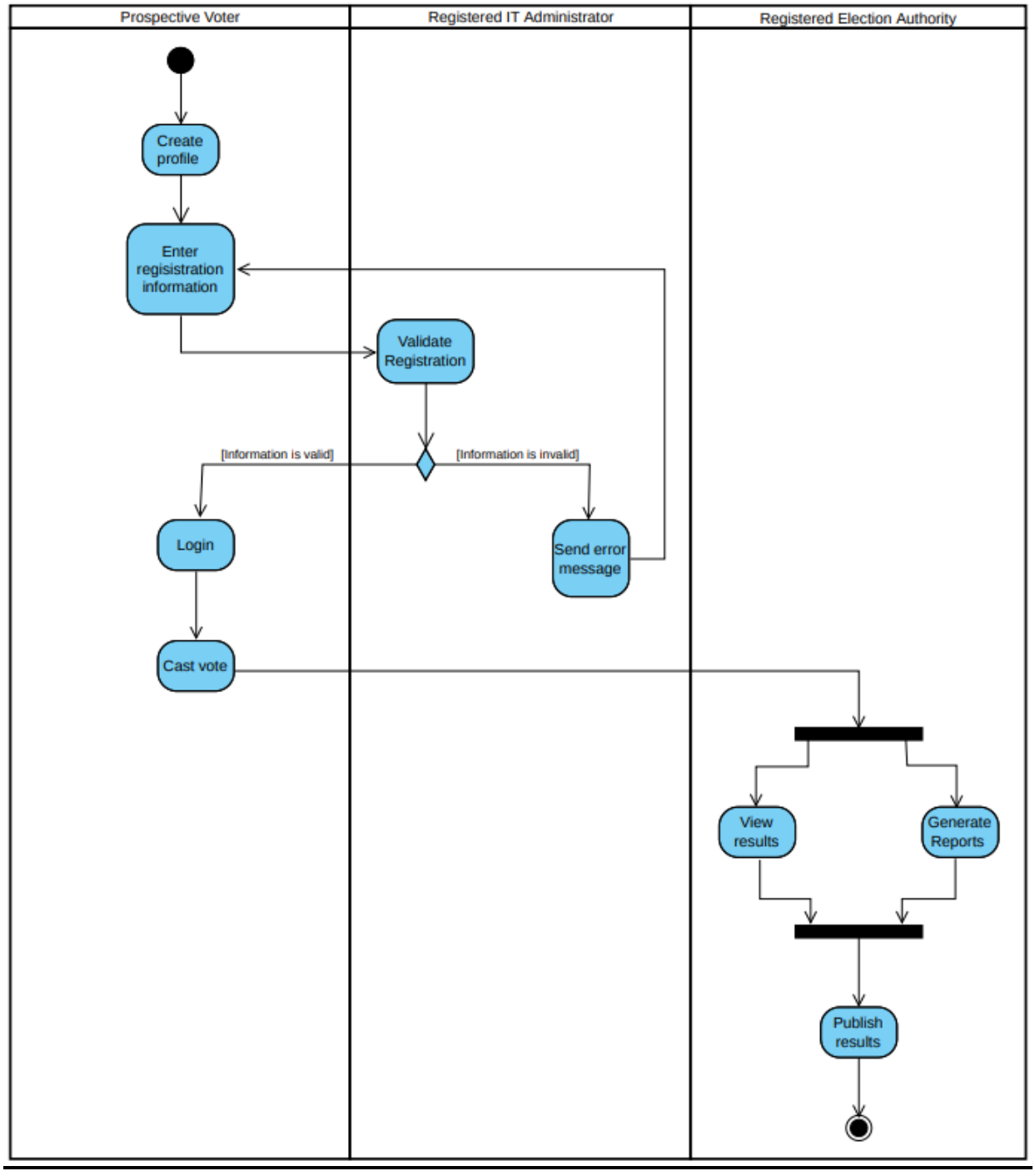


Figure 5: Activity diagram showing the voting process

An activity diagram represents the sequence of actions that are carried out in a system (Ang, 2022). This activity diagram depicts the process a prospective voter may take to successfully cast a vote and by the end of the process, the vote casted is counted towards the final results published. First the prospective voter has to create a profile to gain access to the registration form. Then they would enter their registration information which would be validated by the already registered IT administrator. Once the registration is valid, the user can then later login during the voting period. An invalid registration will produce a warning and the user will be prompted to enter their correct registration information. After logging in, the user can then cast their vote. The registered election authority would be able to view the results after the votes are casted and can generate statistical reports at the same time. Finally, they will publish these results to the website.

System Architectural Design

Data Flow Diagram (DFD)

A data flow diagram is an explosive depiction of how all the data in a system is processed and used by the different entities (Sundar, 2018). In the Elections Management System, the DFD shows exactly how the data entered by the voter is processed throughout the system in order to determine a winner of the elections. This system architecture was chosen to properly show all system inputs, processes and outputs, as well as how data is stored as it moves into and out of the elections management system.

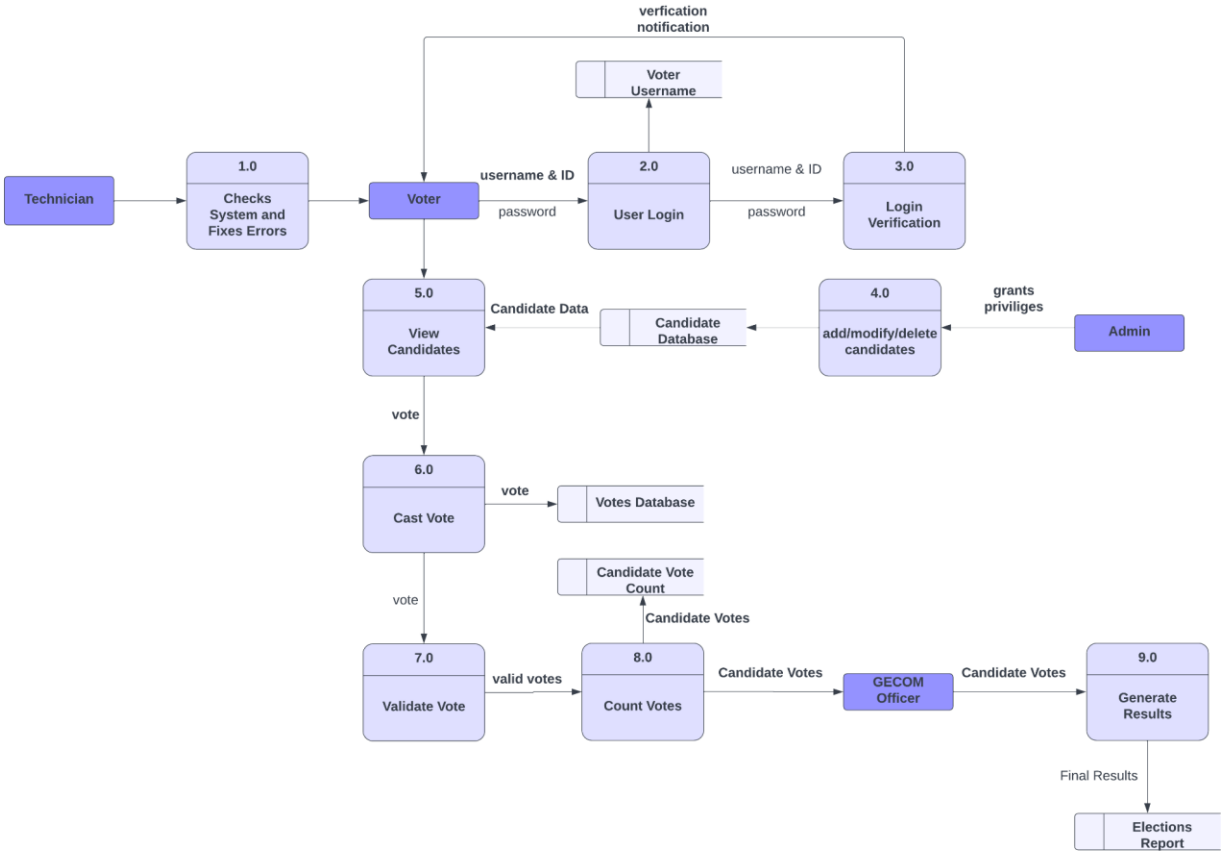
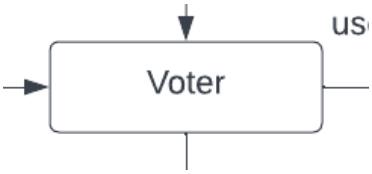


Figure 6: Data Flow Diagram showing the flow and process of information throughout the system

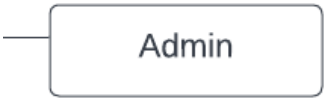
Description of Each Component

Entities

The role of the technician entity is to ensure that the Elections Management System operates as expected.



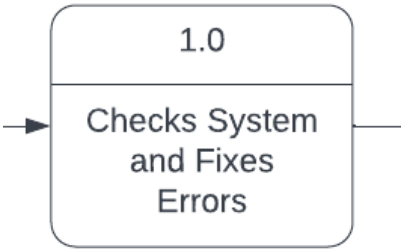
The voter is the main entity of the Elections Management System DFD as they are responsible for logging into the system and casting a vote after verification.



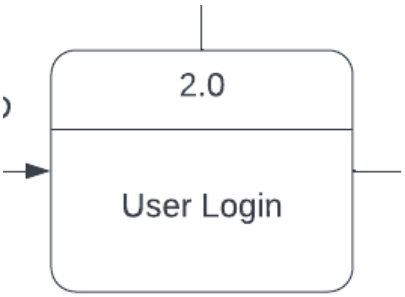
The role of the admin is to provide the necessary data required for the voter to cast a vote once verification is completed.

The role of the GECOM officer is to essentially provide the results of the elections in a statistical manner for public viewing.

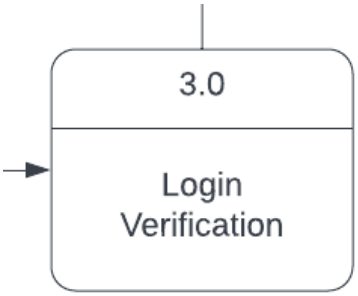
Processes



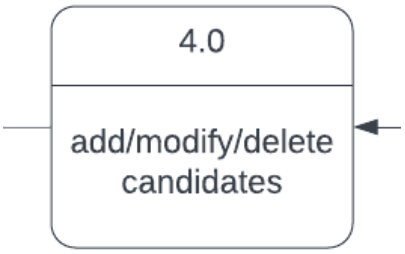
Process one serves as a function of the technician entity which is to check the system to ensure that it is working properly and to fix any error before proceeding to allow the voter to login.



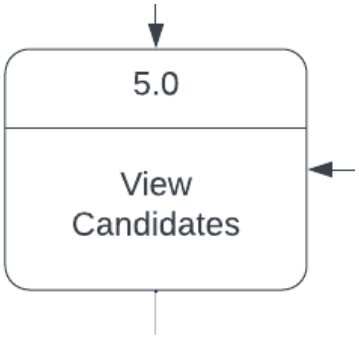
Process two serves as a function of the prospective voter which provides them with an interface to log in to the Elections Management System by providing their username, ID and password.



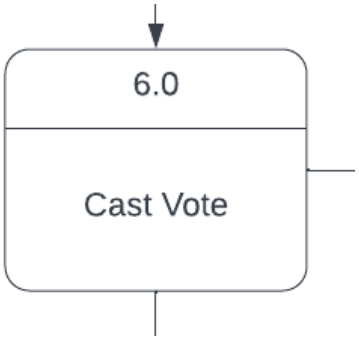
Process three serves the purpose of verifying the identity and eligibility of the prospective voter to determine whether they should be deemed an official voter or not and if they can gain access to the rest of the system.



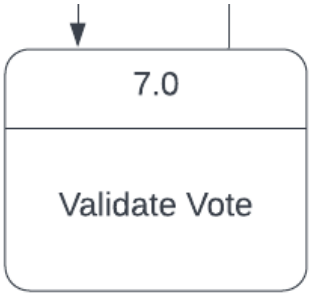
Process four serves as a function of the Admin which is to allow candidate records from the Candidate Database to be added, modified and/or deleted.



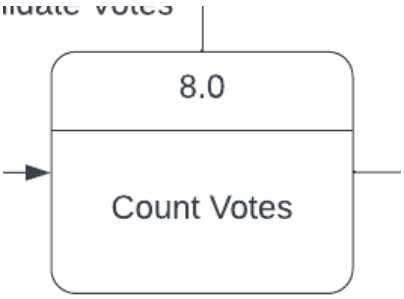
Process five allows the voter to view a list of the necessary information on the candidates contesting in the elections.



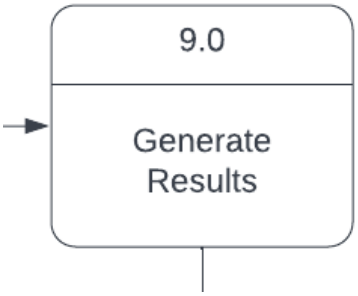
Process six basically allows the voter to select the candidate of their preference from among the list of candidates provided to them.



Process seven serves as a function of the system itself where the vote cast by the voter is deemed either valid or invalid to be counted for the selected candidate.

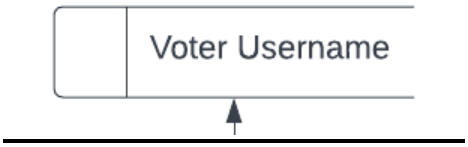


Process eight determines the total number of votes for each candidate which contested in the elections.



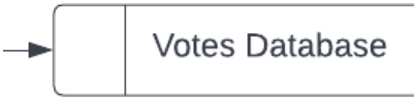
Process nine is the final process of the system which serves the purpose of generating reports inclusive of graphs and charts to display the data collected during the elections. This includes the winner of the elections.

Data Stores

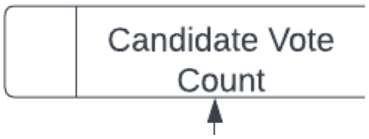


This data store collects and stores the username of the prospective voter if so desired.

The Candidate Database stores all necessary data about the candidates contesting the elections. This would include: their name, constituency and party name among others.



The Votes Database collects and stores the data on the votes cast and the voters which cast the votes to provide for accountability.



This data store keeps a record of the number of valid votes cast for each candidate contesting the elections.

The Elections Report data store keeps all statistical records of the results of the elections in the Elections Management System.

Scenario

Scenario 1.0:
The technician logs into the system and finds an alert that says servers may be down or maybe an overflow of data, the technician is now prompted to fix the problem and get the website up and running.

Scenario 2.0:
Jane, a voter, logs into the system using her email address and password the system then sends her a confirmation code verifying her as the owner of that email address, Jane is now prompted to send her verifying documents to be eligible to vote.

Scenario 3.0:
Jane a voter logs into the system as a voter she sends her verifying documents, the system has verified her as a valid voter, a confirmation letter was sent to her email and she is now allowed to vote.

Scenario 4.0:
The admin logins into the system and is prompted with an interface to see any issues with the network traffic, and persons asking for permission to gain certain privileges, the admin allows or denies this person privileges and can update candidates/parties information.

Scenario 5.0:
Jane has successfully logged into the system and is now allowed to cast a vote, as she clicked the cast vote button a list of candidates and their pictures are now in view. The candidates are John Doe, Ricky Sam, Niketa Johnson and Pat James.

Scenario 6.0:
Jane sees the candidate she wants to vote for, Niketa Johnson, and the system asks Jane if she's sure about the party she has chosen and warns that it cannot be changed later after confirming, Jane has successfully cast her vote.

Scenario 7.0:
The system will add the total number of votes for each candidate, separates the total votes for each region and the overall number of votes for each party, and then waits for GECOM officials to upload/publish the results.

Scenario 8.0:
Mark, Stacy, David, and jack are GECOM moderators, as they log into the system, they can see the data being uploaded to the system, after the election deadline they will go through every region and publish the results for parties and a total/overall vote of each party and the winner of

the election. For this election, Ricky Sam is the winner but the results data about the other three candidates are also still displayed for informational purposes.

Member Contribution Report

Name	Main Task	Percentage Contribution
Carita Morris	**Context Diagram**	**100%**
Angelique Browne	**Use Case Model**	**100%**
Kristeen Chase	**Class Diagram**	**100%**
Bhudram Singh	**Sequence Diagram**	**100%**
Teyana Shivsankar	**Activity Diagram**	**100%**
Rokaylia Thomas	**System Architecture**	**100%**
Waynetta Naughton	**System Architecture**	**100%**

Collaboration Strategy

All members were tasked with a model/diagram to develop with two members being assigned to the system architecture since it carries a heftier requirement as compared to the other diagrams/models.
To benefit all members, meetings and discussions were held where each member would explain their diagram, giving room for everyone to make their input.

References

Ang, J. (2022, April 27). How to Create an Activity Diagram [+Examples]. Venngage. https://venngage.com/blog/activity-diagram/

IBM. (2021, March 5). *IBM Documentation*. Ibm.com. https://www.ibm.com/docs/hr/rsas/7.5.0?topic=uml-sequence-diagrams

Sundar, A. (2018, April 12). *What is Data Flow Diagram?* MindsMapped. What is Data Flow Diagram? | What is DFD? | MindsMapped