Constituency Connect

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The candidate confirms that the work submitted is their own and appropriate credit has been given where reference has been made to the work of others.

DECLARATION

We hereby declare that this software, neither whole nor as a part, has been copied from any source. It is further declared that we have developed this software documentation and accompanied the report entirely based on our efforts. If any part of this project is proved to be copied from any source or found to be a reproduction of some other. We will stand by the consequences. No Portion of the work presented has been submitted to any application for any other degree or qualification of this or any other university or institute of learning.

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CERTIFICATE OF APPROVAL

It is to certify that the final year project of BS (SE) "Constituency Connect" was developed by "Muhammad Ahsan**, 21-ARID-737**", "Haseeb Ur Rehman**, 21-ARID-715**" and "Huzaifa Bin Shahzad**, 21-ARID-719**" under the supervision of "Ms. Farkhanda Qamar" and that in their opinion; it is fully adequate, in scope and quality for the degree of Bachelors of Science in Software Engineering.

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Executive Summary

The **"Constituency Connect"** project is a transformative civic engagement platform designed to bridge the gap between the public (constituents) and their elected representatives. Driven by the need for transparent governance, streamlined communication, and responsive public service, this system leverages modern web technologies to facilitate efficient issue reporting, real-time collaboration, and community engagement within political constituencies. Traditional methods of constituent-representative interaction often suffer from inefficiencies, a lack of accountability, and limited accessibility. Constituency Connect addresses these challenges through a centralized digital platform that empowers users to submit complaints, track status updates, participate in awareness campaigns, view upcoming events, and engage in virtual meetups. The system also equips representatives with tools to manage issues, respond to concerns, and foster two-way communication with the public.

The platform uses a robust MERN (MongoDB, Express.js, React.js, Node.js) stack, ensuring secure access and role-based interaction. Features are developed using agile methodologies, enabling iterative enhancement and responsiveness. Thorough testing, including unit, integration, and usability assessments, ensures reliability and user satisfaction.

By embracing digital innovation and participatory governance, Constituency Connect aims to redefine public service delivery, enhance trust in political representation, and empower citizens through meaningful engagement and transparency.

Acknowledgement

All praise is for Almighty Allah, who bestowed upon us a minute portion of His boundless knowledge under which we were able to accomplish this challenging task.

We are greatly indebted to our project supervisor, Ms. Farkhanda Qamar, for personal supervision, advice, valuable guidance, and the completion of this project. We are also deeply indebted to her for encouragement and continual help during this work.

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Muhammad Ahsan	Haseeb Ur Rehman	Huzaifa Bin Shahzad

Abbreviations

CC	Constituency Connect
CRUD	Create, Read, Update, Delete
UI	User Interface
UX	User Experience
JWT	JSON Web Token
DB	Database
API	Application Programming Interface
VRM	Virtual Representative Meetup
UAT	User Acceptance Testing

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Chapter 1: Introduction

This chapter introduces "Constituency Connect," a project designed to modernize and enhance communication between constituents and their elected representatives. Constituency Connect aims to address the persistent gap in citizen-representative communication with a focus on fostering transparent, efficient, and real-time interactions. This platform empowers constituents to voice concerns and hold representatives accountable by streamlining complaint submission, tracking, and resolution. Simultaneously, it provides representatives with valuable tools to engage meaningfully with their communities. This project combines civic engagement with technological innovation, strengthening democratic practices through user-centric features, such as virtual meetups, real-time notifications, and role-specific functions. Constituency Connect aspires to set a new standard in civic communication by making governance more responsive, inclusive, and transparent.

1.1. Brief Overview

The Constituency Connect project is designed to bridge critical communication gaps between constituents and their elected representatives. In many communities, citizens struggle to engage with representatives meaningfully, often facing limited channels for real-time interaction, delayed responses, and a lack of transparency in complaint tracking and resolution. These communication inefficiencies reduce civic engagement, decrease representative accountability, and contribute to a disconnect between representatives and the people they serve.

Recognizing the importance of timely and transparent communication, Constituency Connect leverages modern technology to provide a unified platform that enables complaint reporting, real-time status updates, virtual meetups, and performance tracking. The platform empowers citizens to voice concerns effectively and fosters accountability by providing representatives with tools to track, prioritize, and address issues systematically. By integrating role-specific access levels, automated notifications, and data visualizations, Constituency Connect enhances the quality of governance and civic engagement. It also includes multi-language support to ensure accessibility across diverse populations.

The project adopts a Kanban methodology to efficiently manage workflow, prioritize tasks, and ensure continuous progress with minimal team resources, ensuring that the development process remains flexible and responsive to evolving user needs. By continuously iterating feedback, Constituency Connect aims to build a responsive, accessible, and impactful platform that strengthens democratic communication and enhances public service effectiveness.

1.2. Relevance to Course Modules

- **Web Development**:
  This course provided the foundational skills necessary to develop the web-based system for Constituency Connect, focusing on front-end and back-end development aspects.
- **Object-Oriented Analysis and Design**:
  Through this course, we learned how to model and structure the system using use cases, activity diagrams, and sequence diagrams, which are crucial for developing efficient and organized architecture.
- **Database Management**:
  This course was instrumental in designing and implementing the database for the project, ensuring efficient data handling, storage, and retrieval.
- **Human-Computer Interaction**:
  This module informed us of our approach to creating a user-friendly interface, essential for promoting accessibility and ease of use for diverse users.
- **Software Project Management**:
  Key concepts from this course helped us plan, manage tasks, and use Kanban to streamline workflow and track project progress effectively with a small team.

1.3. Project Background

The "Constituency Connect" project addresses a critical need for improved communication and accountability between elected representatives and their constituents. Traditional channels of communication often lack transparency, timely feedback, and the ability to track the progress of complaints or requests. Constituency Connect aims to address these challenges

by providing a digital platform that facilitates structured communication, complaint management, and real-time interaction.

The platform enables constituents to report issues, monitor their progress, and engage in virtual meetings with representatives, fostering greater civic participation and accountability. Constituents can also access public event calendars, participate in surveys, and view representative performance metrics. By utilizing modern web technologies and a streamlined user experience, the system enhances both accessibility and transparency.

Additionally, the project leverages role-based access control to ensure that representatives, constituents, and department officials can interact within their specific functional roles, promoting data security and efficient workflow management. This initiative highlights the importance of digital engagement in governance, presenting a scalable model for strengthening democratic processes and bridging the gap between government officials and the public.

1.4. Literature Review

Many democratic societies face a significant communication barrier between elected officials and their constituents. Direct interaction with representatives is often limited to individuals with special connections or high social status. In contrast, the average citizen's interaction is typically limited to brief encounters during election seasons or at local events. These irregular interactions rarely address the ongoing needs and concerns of the community. This lack of meaningful engagement has led to a sense of disconnection among citizens who feel their voices are unheard in the democratic process. As a result, community issues frequently go unaddressed, and public trust in government institutions continues to diminish.

By addressing these existing problems, Constituency Connect has the potential to significantly transform the relationship between citizens and their government, leading to more responsive, efficient, and democratic governance.

- **FixMyStreet** is a platform designed to help citizens report local issues, such as potholes, broken streetlights, and other community problems, directly to their local government. This user-friendly tool allows residents to track the progress of their reports, ensuring that public concerns are addressed efficiently and effectively.

- **SeeClickFix** is a community-driven platform that enables residents to report non-emergency issues in their neighborhood, such as damaged infrastructure, public safety concerns, and other local problems. This interactive approach encourages active community engagement and helps to build a stronger, more connected neighborhood.
- **Neighbour-land** is a civic engagement platform that empowers residents to collaborate with their local government and community organizations on neighborhood improvement projects. It focuses on gathering ideas, feedback, and support from the community to shape public spaces and policies. By facilitating open dialogue and collective action, it helps to create more vibrant, inclusive, and responsive communities.
- **PM Citizen Portal** is a government platform started by the Prime Minister's Office in 2018 to connect citizens with the government more effectively. It works as a central system for handling complaints, allowing people to register issues, give suggestions, and find information about various public services. You can access the portal through a mobile app or a website, making it easy to file complaints against any government department or service provider. Once you submit a complaint, the system sends it to the right authorities for resolution and keeps you updated on its status in real time. The Pakistan Citizen Portal is a key part of the government's effort to improve transparency, accountability, and the quality of public services. By giving citizens, a direct way to voice their concerns and engage with the government, the portal empowers people and helps create a more responsive and inclusive system.

1.5. Analysis from Literature Review

Our analysis reveals key alignments and distinctions between Constituency Connect and other platforms that bridge communication gaps between government representatives and citizens. Constituency Connect complements and extends the functionality of existing platforms by integrating various civic engagement tools, promoting a continuous, interactive, and transparent relationship between representatives and constituents. This approach contributes to more responsive and democratic local government.

Table 1.1: Literature Review

Features	Constituency Connect	FixMyStreet	SeeClickFix	Neighbourland
Origin	Pakistan	United Kingdom	United States	United States
Complaint Reporting	Yes,	Yes,	Yes	No
Complaint Tracking	Yes	Limited	Yes	No
Complaint Prioritization	Yes	No	No	No
Virtual Meetups	Yes	No	No	Yes
Surveys and Polls	Yes,	No	No	Yes
Event Calendar	Yes,	No	No	No
Feedback	Yes	Yes	Yes	Yes
Performance Metrics	Yes	No	No	No
Security	Standard	Standard	Standard	Standard

Table 1.2: Comparison with system in local landscape

Features	Constituency Connect	PM Citizen Portal
Origin	Pakistan	Pakistan
User Roles	Constituents, Representatives, Assistants, Complaint Handlers	Citizens, Government Officials
Profile Management	Yes, detailed profiles with editable information	Yes, detailed profiles with editable information
Complaint Reporting	Yes, including anonymous reporting and detailed tracking	Yes, with broad categorization
Complaint Tracking	Yes, with full history and status updates	Status updates are available through the portal
Complaint Prioritization	Yes	No
Automated Complaint Routing	Yes	Forwarded to concerned government departments
Virtual Meetups	Yes	Not available
Security	Standard	Standard
Feedback	Yes, Feedback about problem resolution	Limited
Performance Metrics	Yes, tracks and displays the performance metrics	No

1.6. Methodology and Software Lifecycle for This Project

For the Constituency Connect project, we have chosen the Kanban methodology. This approach suits our small team due to its flexibility, simplicity, and the emphasis it places on visualizing the work process. Kanban will enable us to manage tasks more effectively by ensuring continuous flow and minimizing bottlenecks, which is ideal for our team. Kanban's focus on visualizing tasks, setting priorities, and delivering features as they are completed will provide constant insight into our progress, allowing for better decision-making.

1. **Requirements Elicitation**

   The project will begin with an in-depth understanding of the system's needs and requirements. The team will carefully gather input from stakeholders to make sure the features we develop match user needs perfectly.

2. **Design**

   The design phase will focus on structuring the system architecture and database schema. We will also define the UI/UX components to ensure users have a seamless experience when engaging with the platform.

3. **Construction / Iteration**

   We will proceed with incremental development, breaking down tasks into smaller pieces of work. This will involve building and testing features iteratively, ensuring each function is completed before moving on to the next.

4. **Testing**

   Testing is integrated into each stage of development. Continuous testing will be done as part of each iteration to ensure that features work correctly and meet quality standards. Automated testing tools will be used for quick feedback and bug resolution.

5. **Deployment**

   Deployment will occur as new features are completed and validated, following successful iterations. Once the features are validated, they will be deployed to the production environment.

6. **Feedback**

   Feedback from the stakeholders will be collected continuously, helping to refine the system and prioritize the next set of features for development. This feedback loop ensures that the product meets evolving user needs.

Key Roles:

The key roles in the system development include

- **Project Lead:**

  Acts as the Kanban "service delivery manager," prioritizing tasks based on project goals and managing workflow efficiency. This role ensures the project stays aligned with high-level objectives and communicates any adjustments to meet stakeholder needs.
- **Development Lead:**

  Oversees the technical aspects, functioning similarly to a "flow manager." They help address bottlenecks, guide the technical direction, and facilitate collaboration across tasks.
- **Developers:**

  Each developer focuses on their assigned tasks within the Kanban board. With clearly defined tasks in each column (e.g., To-Do, In-Progress, Testing, Done), developers work independently, pulling tasks as they progress.

1.6.1. Rationale behind Selected Methodology

The Kanban methodology was chosen for the following reasons:

1. **Visualizing Work:**

   Kanban provides a clear and visual representation of work items, allowing the team to prioritize tasks, track progress, and identify bottlenecks in real-time.
2. **Flexibility and Adaptability:**

   Kanban's flexibility allows us to adapt to changes and adjust our work priorities quickly, which is essential given the changing needs of constituents and representatives.
3. **Efficient Resource Management:**

   With our small team, Kanban helps optimize resources by enabling us to focus on manageable tasks, reducing the risk of overload and increasing efficiency.

4. **Continuous Delivery:**

   The Kanban approach supports the continuous delivery of incremental features, ensuring that the most valuable functionality is available to users as soon as it is ready.

5. **Minimizing Waste:**

   Kanban emphasizes efficiency, minimizing delays between stages, and ensuring the team can focus on high-priority tasks, reducing wasted time.

6. **Improved Collaboration:**

   Kanban encourages frequent communication between team members and stakeholders, improving collaboration and the overall quality of the project.

Chapter 2: Problem Definition

This chapter outlines the key challenges that the Constituency Connect project aims to address in improving communication and accountability between constituents and their elected representatives. Traditionally, communication is confined to election periods, which often fail to address ongoing, everyday issues of the public effectively and lack consistent follow-up.

Such limitations result in a disconnection between citizens and representatives, leading to under-addressed issues, and decreasing public trust in governmental institutions. This project intends to address these issues by creating a structured digital platform where constituents can report concerns, track updates, and directly engage with representatives, creating a continuous feedback loop. Additionally, representatives benefit from insights into public sentiment and an organized method to track and respond to issues effectively.

The goal is to develop a centralized system that facilitates transparent, accountable communication and provides actionable insights to both representatives and constituents. By identifying these gaps in civic engagement and public service accountability, this chapter lays the groundwork for understanding the project's potential to enhance civic participation and governmental responsiveness. This chapter explains how Constituency Connect plans to make communication more open, and easy by providing a web-based platform focused on the needs of both citizens and representatives.

2.1. Problem Statement

Although various complaint management systems exist, significant gaps remain in effectively connecting constituents with their representatives. Current communication channels are often inefficient and unreliable and lack real-time interaction, causing delays in complaint resolution and weakening civic engagement. This results in slow problem resolution, reduced accountability, and a growing disconnect between representatives and the public. Citizens struggle to file complaints, track progress, or receive timely responses, highlighting the need for a unified solution that improves communication, transparency, and governance.

2.2. Deliverable and Development Requirements

For the *Constituency Connect* project, defining clear deliverables and development requirements is essential for effective project management and achieving the intended impact. Deliverables represent tangible outputs, while development requirements ensure that each component meets necessary technical and functional standards.

- **Deliverables:**

In Constituency Connect, the deliverables represent the measurable outputs or milestones to be achieved throughout the project. Key deliverables include:

1. **User-Centered Web Platform**:
   A fully functional web application with a seamless, responsive interface designed for constituents to submit issues, track progress, and receive updates from representatives, optimizing the user experience across different devices.
2. **Role-Based Access and Permissions System**:
   A secure role-management system to allow customized access levels for Constituents, Representatives, and Complaint Handlers, ensuring data privacy and appropriate permissions for each user.
3. **Complaint Management System**:
   A streamlined system that enables representatives to categorize, prioritize, and address issues efficiently, ensuring timely responses to constituent concerns and transparent tracking of issue status.
4. **Automated Notifications and Alerts**:
   Real-time notification system to inform users of updates or status changes on their submissions, enabling constituents and representatives to stay engaged with issue progress.
5. **Data Analytics Dashboard**:
   An integrated dashboard providing representatives with insights on frequently reported issues, resolution times, and response trends, supporting data-driven decision-making and accountability.

6. **Detailed Documentation:**
   Comprehensive documentation, including technical specifications, and setup instructions for end-users to maximize usability and functionality.
7. **Performance Reports**:
   Reports that summarize complaint management efficiency and other metrics, demonstrate the platform's impact on civic engagement.

These deliverables ensure Constituency Connect provides a secure, user-friendly, and effective platform that fosters transparent communication and accountability between constituents and their representatives.

- ## Development Requirements:

The development requirements define the technical aspects necessary to achieve the desired functionalities of *Constituency Connect*. The following requirements will ensure the platform's successful implementation and alignment with project goals:

1. **User-Friendly Interface**:
   Design an intuitive, accessible interface to facilitate easy navigation and usage for all users, including multi-language support to accommodate diverse communities.
2. **Role-Based Access Control**:
   Set up access control protocols to define permissions for different user roles (e.g., constituents, representatives, departmental officials), ensuring data integrity and efficient workflows.
3. **Continuous Improvement**:
   Incorporate tools and frameworks for regular monitoring, testing, and improvement of functionalities to maintain the high performance and reliability of the system.
4. **Ethical and Compliance Standards**:
   Adhere to ethical standards for fair data usage, transparency in communication, and respect for citizens' rights, aligning with democratic and legal principles.
5. **Scalability and Reliability:**
   Ensure the platform can handle increasing user traffic and data without performance degradation.

6. **Data Privacy and Security:**

   Implement robust security measures to protect sensitive user data, particularly considering the sensitive nature of constituent-representative communication.

7. **Efficient Data Management:**

   Implement efficient data handling and storage techniques to allow easy retrieval, filtering, and sorting of user-submitted issues and reports.

These requirements will guide the development process to meet high standards of usability, functionality, and security, ensuring that Constituency Connect fulfills its objective of improving democratic engagement and public service accountability.

Chapter 3: Requirement Analysis

This chapter delves into the requirements for the project, "Constituency Connect." The Software Requirements Specification (SRS) document is central to this analysis, comprehensively outlining the system's essential functionalities, user roles, and technical requirements for successful implementation. The SRS defines the project's scope, aligning user needs with system features and providing clarity on the platform’s purpose, performance goals, and expected outcomes.

The chapter underscores the importance of thorough requirement gathering to effectively guide the project's direction. Through detailed stakeholder engagement and iterative feedback, the team gains a deep understanding of constituent needs, representative functionalities, and system usability expectations. This comprehensive approach helps identify key use cases and user stories that drive the platform’s design and development, ensuring Constituency Connect meets its objective of improving communication and responsiveness between government representatives and their constituents.

3.1. Use Cases

The use cases outlined in this section provide a comprehensive overview of user interactions with the Constituency Connect system, detailing how various roles engage with the platform to accomplish key tasks. These use cases clarify core functionalities, validate requirements, and capture the essential interactions between constituents, representatives, and administrative roles. They include scenarios such as complaint submission, complaint tracking, response management, and notifications, demonstrating the system’s responsiveness to a wide range of user needs.

By illustrating how Constituency Connect addresses tasks from complaint lodging to resolution tracking, the use cases facilitate clear communication between stakeholders and the development team. This alignment of requirements and expectations ensures that the project is developed with a focus on user needs, guiding the creation of a platform that fosters efficient and transparent communication between constituents and their representatives.

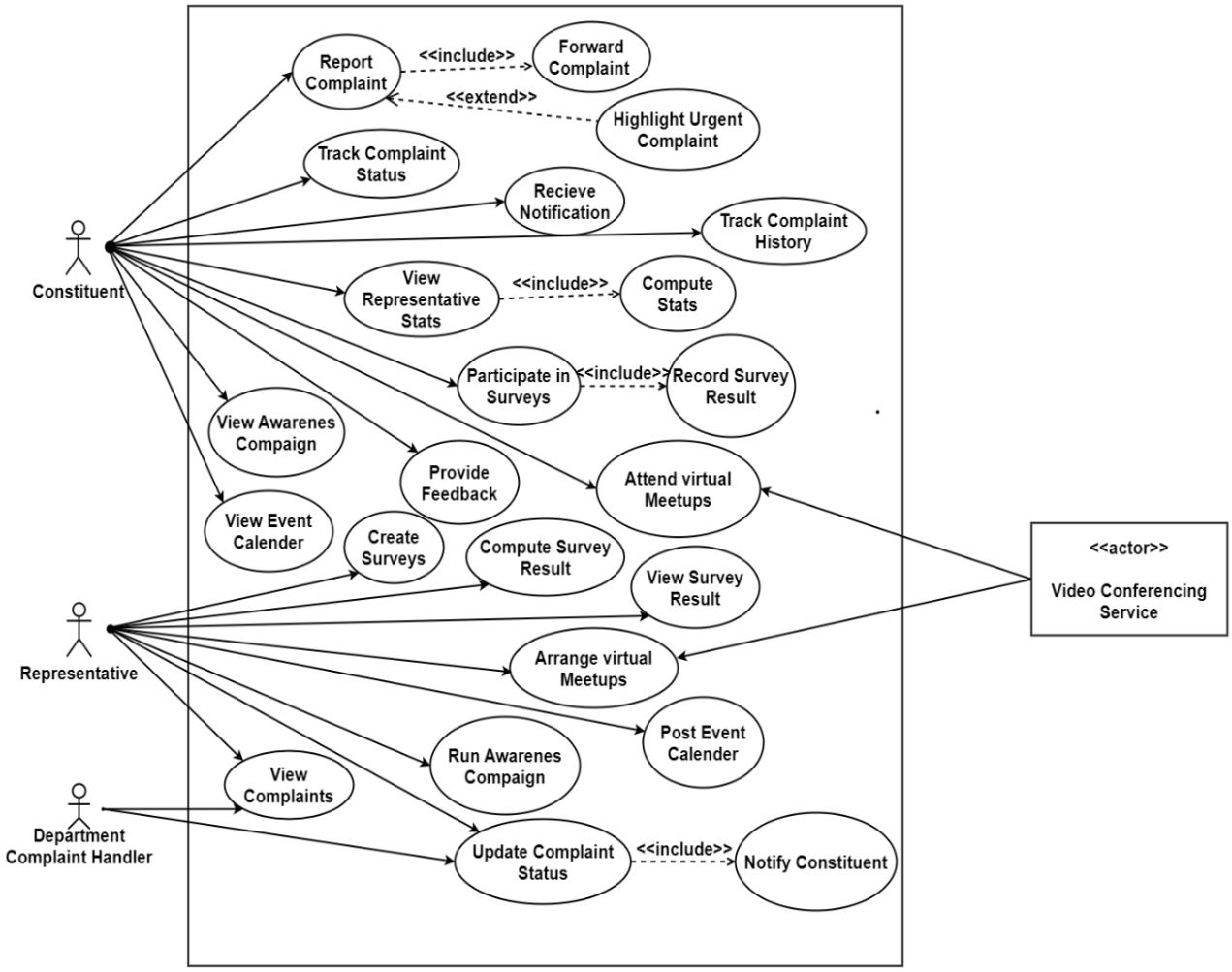

Fig 3.1: Use Case diagram

3.1.1. Actor Description

The actors and the description of the actors are as follows.

1. **Constituent:**

   Description: Constituents are citizens who interact with the system to register complaints, provide feedback, and communicate with representatives. Their primary role involves submitting issues that need resolution, accessing their case status, and engaging with representatives via the platform's tools, including video conferencing as needed. Their interactions help ensure that representatives understand the needs of their constituencies.

2. **Representative:**

   Description: Representatives, such as parliamentarians, respond to constituent issues, initiate actions, and review feedback. They interact with constituents through various communication modes, including virtual meetups. Their involvement is vital to resolving cases, addressing public concerns, and improving community welfare based on received complaints and feedback.

3. **Department Complaint Handler:**

   Description: Represents various government departments or agencies responsible for handling specific types of complaints (e.g., health services). They receive complaints, provide status updates, and close complaints upon resolution.

4. **Video Conferencing System (Secondary Actor):**

   Description: Integrated as a secondary actor, the video conferencing system facilitates direct communication between constituents and representatives. This functionality is essential for more complex cases that require in-depth discussion. It enhances engagement and improves case resolution efficiency by enabling real-time interaction.

3.2. Use Case Description

The following are the Expanded Use Cases of our System.

3.2.1. Report Complaint

Table 3.1: Report Complaint

Use Case ID:	UC-01
Use Case Name:	Report Complaint
Actors:	Constituent
Description:	Enable a constituent to complain about an issue requiring attention
Trigger:	The constituent identifies a problem and wishes to report it.
Preconditions:	1. The constituent must be registered in the system. 2. The reported issue must fall within a valid category recognized by the system.

Postconditions:	1. The complaint is recorded in the system and assigned a unique identifier. 2. Notifications may be sent to relevant stakeholders.
Normal Flow:	1. Constituent identifies an issue they wish to report. 2. Constituent initiates the process to report a complaint. 3. The constituent submits the complaint. 4. The system validates the details and creates a complaint record. 5. The system confirms the successful submission to the constituent and generates a unique complaint ID. 6. The system routes the complaint to the relevant representative or department.
Alternative Flows:	**Missing Information:** If mandatory information is missing, the system prompts the user to complete the fields.
Special Requirements:	The system should ensure the security of sensitive complaint information.
Assumptions:	Constituents have access to the internet to report complaints. Notes and Issues
Notes and Issues:	None

3.2.2. Forward Complaint

Table 3.2: Forward Complaint

Use Case ID:	UC-02
Use Case Name:	Forward Complaint
Actors:	Constituent (Primary), Representative, Department Complaint Handler
Description:	Allows a constituent's complaint to be forwarded to the appropriate authority for resolution.
Trigger:	The complaint is determined to require attention from a specific authority.
Preconditions:	The complaint must already exist in the system.
Postconditions:	The complaint is successfully forwarded to the selected authority, and its status is updated.
Normal Flow:	1. The system determines where the complaint needs to be forwarded.

	2. The forwarding process is initiated. 3. The system sends complaints to the selected authority, including its status.
Alternative Flows:	**Incorrect Category:** If the complainant selects the wrong category, DCH or the Representative can forward it to the right authority.
Includes:	None
Special Requirements:	Must ensure reliable tracking of forwarded complaints.
Assumptions:	Authorities are already registered in the system
Notes and Issues:	None

3.2.3. Highlight Urgent Complaint

Table 3.3: Highlight Urgent Complaint

Use Case ID:	UC-03
Use Case Name:	Highlight Urgent Complaint
Actors:	Constituent
Description:	Allows a constituent to mark a complaint as urgent, ensuring it receives priority handling.
Trigger:	The system identifies the complaint as requiring immediate attention.
Preconditions:	The complaint must exist in the system.
Postconditions:	The complaint is marked as urgent, and notifications are sent to relevant stakeholders.
Normal Flow:	1. Constituent identifies an existing complaint 2. The system verifies that the complaint qualifies for urgency. 3. The system marks the complaint as urgent and notifies the relevant stakeholders.
Alternative Flows:	None
Includes:	None
Exceptions:	None
Special Requirements:	None
Assumptions:	Stakeholders are equipped to handle urgent complaints.
Notes and Issues:	None

3.2.4. Track Complaint Status

Table 3.4: Track Complaint Status

Use Case ID:	UC-04
Use Case Name:	Track Complaint Status
Actors:	Constituent
Description:	Enables constituents to check the current status of their complaints.
Trigger:	The constituent wishes to know the status of a complaint
Preconditions:	The constituent must have submitted at least one complaint.
Postconditions:	The constituent is informed of the complaint's current status and history.
Normal Flow:	1. Constituent initiates the request to track a complaint. 2. The system prompts for the complaint ID. 3. The constituent provides the complaint ID. 4. The system retrieves and displays the status and progress of the complaint.
Alternative Flows:	**Invalid Complaint ID:** If the ID provided does not exist, the system notifies the user and prompts them to retry.
Includes:	None
Exceptions:	None
Special Requirements:	None.
Assumptions:	Complaint records are stored securely and reliably.
Notes and Issues:	None

3.2.5. Receive Notification

Table 3.5: Receive Notification

Use Case ID:	UC-05
Use Case Name:	Receive Notification
Actors:	Constituent
Description:	Provides constituents with updates, announcements, or alerts regarding complaints, events, or surveys.
Trigger:	A notification is triggered by an event in the system.
Preconditions:	The constituent must be registered.
Postconditions:	The notification is successfully delivered to the constituent.

Normal Flow:	1. A triggering event (e.g., complaint update, survey invitation) occurs. 2. The system identifies the target constituent(s) for the notification. 3. The system sends the notification. 4. The constituent receives the notification.
Alternative Flows:	**Notification Delivery Failure:** The system logs the failure and retries to send the notification.
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	None
Notes and Issues:	None

3.2.6. Track Complaint History

Table 3.6: Track Complaint History

Use Case ID:	UC-06
Use Case Name:	Track Complaint History
Actors:	Constituent
Description:	Allows a constituent to view the complete history and updates of their complaints
Trigger:	The constituent wants to review their past complaints.
Preconditions:	The constituent must have submitted at least one complaint.
Postconditions:	The constituent is presented with the complaint's historical details.
Normal Flow:	1. Constituent initiates the request to view complaint history. 2. The system retrieves all complaints associated with the constituent. 3. The constituent selects a specific complaint to view its history. 4. The system displays a detailed history, including updates and actions taken.
Alternative Flows:	**No Complaints Found:** If no complaints are associated with the constituent, the system notifies them accordingly.

Exceptions:	None
Includes:	None
Special Requirements:	Complaint history must be accurate and complete.
Assumptions:	Complaint records are maintained indefinitely.
Notes and Issues:	None

3.2.7. View Representative Stats

Table 3.7: View Representative Stats

Use Case ID:	UC-07
Use Case Name:	View Representative Stats
Actors:	Constituent.
Description:	Enable constituents to view statistical data regarding the performance and activities of their elected representatives.
Trigger:	A constituent wants to evaluate the effectiveness of a representative based on statistics.
Preconditions:	1. The representative must have performance data recorded in the system. 2. The constituent must have access to the representative's public data.
Postconditions:	The constituent is presented with detailed statistics on the representative's activities.
Normal Flow:	1. Constituent requests to view representative statistics. 2. The system retrieves the representative's statistical data from the database. 3. The system displays aggregated statistics such as the number of resolved complaints, surveys conducted, and events organized.
Alternative Flows:	**No Data Available:** If no statistics are recorded, the system notifies the constituent.
Includes:	Compute Stats
Exceptions:	None
Special Requirements:	Must ensure data accuracy and prevent manipulation of stats.

Assumptions:	Representatives' activities are tracked consistently.
Notes and Issues:	Data visualization tools should be understandable for non-technical users.

3.2.8. Compute Stats

Table 3.8 Compute Stats

Use Case ID:	UC-08
Use Case Name:	Compute Stats
Actors:	System (Primary), Representative (Secondary)
Description:	Automatically calculates performance statistics based on data recorded in the system.
Trigger:	The system detects new data or a request to compute statistics.
Preconditions:	1. Representative activities are logged into the system. 2. The system must have pre-configured statistical algorithms.
Postconditions:	The updated statistics are accessible for constituents and representatives to view
Normal Flow:	1. The system identifies updated data from complaints, surveys, and events. 2. The system applies predefined algorithms to compute statistics such as response rates, resolution times, and survey participation. 3. The computed stats are stored for future retrieval.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	Algorithms must be optimized for large datasets.
Assumptions:	Representative activity data is updated frequently.
Notes and Issues:	None

3.2.9. Participate in Survey

Table 3.9: Participate in Survey

Use Case ID:	UC-09
Use Case Name:	Participate in Survey
Actors:	Constituent
Description:	Enables constituents to participate in surveys created by representatives to collect community feedback.
Trigger:	A constituent is invited or wishes to respond to a survey.
Preconditions:	1. The constituent must have access to the survey. 2. The survey must be active.
Postconditions:	The survey response is recorded and linked to the respective constituent.
Normal Flow:	1. The constituent selects an active survey to participate in. 2. The system presents the survey questions. 3. Constituent responds to each question. 4. The system validates and submits the responses. 5. The system confirms successful submission to the constituent.
Alternative Flows:	None
Exceptions:	None
Includes:	Record Survey Result
Special Requirements:	Surveys must support multiple question types (e.g., multiple choice, open-ended).
Assumptions:	None
Notes and Issues:	None

3.2.10. Record Survey Result

Table 3.10: Record Survey Result

Use Case ID:	UC-10
Use Case Name:	Record Survey Result
Actors:	System (Primary), Representative (Secondary)
Description:	Captures and stores survey responses submitted by constituents

Trigger:	A constituent submits survey responses.
Preconditions:	The survey must exist, and questions must be defined.
Postconditions:	Survey responses are stored and linked to the respective survey.
Normal Flow:	1. The system receives survey responses from a constituent. 2. The system validates the responses against the survey structure. 3. The responses are stored in the database. 4. The system updates survey participation statistics
Alternative Flows:	**Invalid Responses:** The system rejects incomplete or invalid responses.
Exceptions:	None
Includes:	None
Special Requirements:	Ensure responses are stored properly.
Assumptions:	None
Notes and Issues:	None

3.2.11. Attend Virtual Meetups

Table 3.11: Attend Virtual Meetups

Use Case ID:	UC-11
Use Case Name:	Attend Virtual Meetups
Actors:	Constituent (Primary), Video Conferencing Service (Secondary)
Description:	Enables constituents to join virtual meetings hosted by representatives to discuss community issues.
Trigger:	A constituent is invited to a virtual meeting or wishes to join one.
Preconditions:	The meeting must be scheduled and active.
Postconditions:	The constituent successfully joins the virtual meeting.
Normal Flow:	1. Constituent receives an invitation to a virtual meeting. 2. The system verifies the meeting details and provides a join link. 3. The constituent initiates the process of joining the meeting.

	4. The system authenticates the constituent and redirects them to the video conferencing platform. 5. The video conferencing service establishes the connection.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	None
Notes and Issues:	None

3.2.12. Provide Feedback

Table 3.12: Provide Feedback

Use Case ID:	UC-12
Use Case Name:	Provide Feedback
Actors:	Constituent
Description:	Allows constituents to submit feedback on complaint resolution.
Trigger:	A constituent wishes to share their feedback regarding their experience.
Preconditions:	A constituent's complaint must be closed (resolved or rejected).
Postconditions:	Feedback is recorded and stored for review by relevant authorities.
Normal Flow:	1. Constituent accesses the feedback section. 2. Constituent provides detailed feedback, including optional ratings or attachments. 3. The system validates the feedback form. 4. Feedback is submitted and stored in the database. 5. The system acknowledges the feedback submission to the constituent.
Alternative Flows:	**Incomplete Form:** If required fields are left empty, the system prompts the constituent to complete them before submission.
Exceptions:	None
Includes:	None

Special Requirements:	None
Assumptions:	Constituents provide honest and constructive feedback.
Notes and Issues:	None

3.2.13. View Awareness Campaign

Table 3.13: View Awareness Campaign

Use Case ID:	UC-13
Use Case Name:	View Awareness Campaign
Actors:	Constituent
Description:	Allow constituents to view active awareness campaigns initiated by representatives.
Trigger:	A constituent wishes to learn about ongoing community awareness initiatives.
Preconditions:	1. Awareness campaigns must be published and active. 2. The constituent must have access to the platform.
Postconditions:	The constituent views details of the awareness campaign.
Normal Flow:	1. Constituent navigates to the awareness campaign section. 2. The system retrieves all active campaigns from the database. 3. The system displays campaigns, including descriptions, and schedules. 4. The constituent selects a campaign to view detailed information.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	Campaigns must include engaging content.
Assumptions:	Constituents regularly check for campaign updates.
Notes and Issues:	Ensure campaigns are accessible across devices and platforms.

3.2.14. View Awareness Campaign

Table 3.14: View Event Calendar

Use Case ID:	UC-14
Use Case Name:	View Event Calendar
Actors:	Constituent
Description:	Enables constituents to view scheduled events such as virtual meetups, surveys, or community initiatives.
Trigger:	A constituent wants to check upcoming events in their community
Preconditions:	The system must have an updated event calendar.
Postconditions:	The constituent views the list of events with corresponding details.
Normal Flow:	1. Constituent accesses the event calendar section. 2. The system retrieves the event details from the database. 3. The system displays the event calendar, showing dates and brief descriptions. 4. The constituent selects an event for detailed information.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	Events are updated in the system promptly.
Notes and Issues:	Ensure the calendar is visually clear and user-friendly.

3.2.15. Create Survey

Table 3.15: Create Surveys

Use Case ID:	UC-15
Use Case Name:	Create Surveys
Actors:	Representative
Description:	Allows representatives to create surveys for constituents to gather feedback or opinions on various topics.
Trigger:	A representative decides to initiate a survey to collect data from constituents.

Preconditions:	The system must support survey creation functionality.
Postconditions:	The survey is saved and becomes available for constituents to participate in.
Normal Flow:	1. The representative navigates to the survey creation section. 2. The system prompts the representative to define the survey title. 3. The representative adds questions, specifying formats (e.g., multiple-choice, text response). 4. Representative sets survey parameters, including start and end dates and visibility. 5. The system validates the survey and saves it in the database. 6. The survey is published.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	The survey must support multiple question types and allow scheduling.
Assumptions:	None
Notes and Issues:	Ensure surveys are accessible on all devices.

3.2.16. Compute Survey Results

Table 3.16: Compute Survey Results

Use Case ID:	UC-16
Use Case Name:	Compute Survey Results
Actors:	Representative
Description:	Enables representatives to calculate and analyze survey responses for insights.
Trigger:	A representative wants to analyze data from a completed survey.
Preconditions:	The survey must be completed and responses stored in the database.
Postconditions:	Survey results are computed and presented in a report format.
Normal Flow:	1. The representative selects a complete survey for analysis. 2. The system retrieves survey responses from the database.

	3. The system computes results, generating aggregated statistics and insights. 4. Representative views results in graphical and tabular form.
Alternative Flows:	**No Responses:** If there are no available responses, the system alerts the representative.
Exceptions:	None
Includes:	None
Special Requirements:	The system should support advanced data visualization.
Assumptions:	Responses are complete and accurately recorded.
Notes and Issues:	Ensure reports are exportable for external use.

3.2.17. View Survey Results

Table 3.17: View Survey Results

Use Case ID:	UC-17
Use Case Name:	View Survey Results
Actors:	Representative
Description:	Allows representatives to review computed results and gain insights from constituent responses.
Trigger:	A representative seeks to view results of a previously conducted survey
Preconditions:	Survey results must be computed and available in the database.
Postconditions:	Survey results are displayed to the representative.
Normal Flow:	1. The Representative accesses the survey results section. 2. The system lists all completed surveys with available results. 3. The representative selects a specific survey to assess detailed results. 4. The system displays computed results in visual formats.
Alternative Flows:	**No Results:** The system notifies the representative if results are unavailable.
Exceptions:	None
Includes:	None

Special Requirements:	None
Assumptions:	Results are accurate and formatted for easy understanding.
Notes and Issues:	None

3.2.18. Arrange Virtual Meetups

Table 3.18: Arrange Virtual Meetups

Use Case ID:	UC-18
Use Case Name:	Arrange Virtual Meetups
Actors:	Representative, Secondary Actor: Video Conferencing Service
Description:	Enables representatives to organize virtual meetings with constituents or other stakeholders.
Trigger:	A representative decides to arrange a virtual meetup.
Preconditions:	The video conferencing service must be integrated with the platform.
Postconditions:	Virtual meetup is scheduled and invitations are sent to participants.
Normal Flow:	1. The representative accesses the virtual meetup scheduling section. 2. The system prompts the representative to set a title, date, and time for the meetup. 3. The representative adds participants and specifies the meeting agenda. 4. The system generates a meeting link through the integrated video conferencing service. 5. Invitations are sent to participants.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	Video conferencing service is reliable.
Notes and Issues:	None

3.2.19. Post Event Calendar

Table 3.19: Post Event Calendar

Use Case ID:	UC-19
Use Case Name:	Post Event Calendar
Actors:	Representative
Description:	Allows representatives to create and publish an event calendar to inform constituents about upcoming events.
Trigger:	A representative wants to share event details with constituents.
Preconditions:	The system must support calendar management.
Postconditions:	The event calendar is updated and visible to constituents.
Normal Flow:	1. The representative accesses the event calendar management section. 2. The system displays the current calendar. 3. The representative creates an event, specifying details such as title, date, time, and description. 4. The representative confirms and saves the changes. 5. The system updates the event calendar and notifies constituents.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	Representatives maintain accurate and relevant event details.
Notes and Issues:	None

3.2.20. Run Awareness Campaign

Table 3.20: Run Awareness Campaign

Use Case ID:	UC-20
Use Case Name:	Run Awareness Campaign
Actors:	Representative

Description:	Enables representatives to launch awareness campaigns for constituents on various topics.
Trigger:	A representative has decided to initiate a public awareness campaign.
Preconditions:	The representative must have access to campaign management features.
Postconditions:	The campaign is published and available for constituents to view.
Normal Flow:	1. The representative navigates to the campaign creation section. 2. The system prompts for campaign details such as title, content, and duration. 3. The representative uploads any relevant media or resources. 4. Representative reviews and publishes the campaign. 5. The system broadcasts the campaign to constituents through appropriate channels.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	None
Notes and Issues:	Monitor constituent engagement for campaign effectiveness.

3.2.21. View Complaints

Table 3.21: View Complaints

Use Case ID:	UC-21
Use Case Name:	View Complaints
Actors:	Representative, Department Complaint Handler
Description:	Enable representatives and department complaint handlers to view complaints submitted by constituents.
Trigger:	A user accesses the complaint viewing feature.
Preconditions:	1. Complaints must exist in the system database. 2. The user must have the necessary permissions.

Postconditions:	Complaints are displayed with relevant details.
Normal Flow:	1. The user logs into the system and navigates to the complaints section. 2. The system retrieves complaints from the database. 3. The user sorts of complaints based on criteria such as urgency, status, or date. 4. The system displays the list of complaints.
Alternative Flows:	None
Exceptions:	None
Includes:	None
Special Requirements:	None
Assumptions:	Complaint data is accurate and up to date.
Notes and Issues:	None

3.2.22. Update Complaint Status

Table 3.22: Update Complaint Status

Use Case ID:	UC-22
Use Case Name:	Update Complaint Status
Actors:	Representative, Department Complaint Handler
Description:	Allow authorized actors to update the status of complaints.
Trigger:	A user decides to update the status of a specific complaint.
Preconditions:	1. Complaints must exist in the system database. 2. The user must have the necessary permissions.
Postconditions:	The complaint status is updated and reflected in the system.
Normal Flow:	1. The user selects a complaint from the list. 2. The system displays details of complaints, including the status. 3. The user updates the status and provides optional remarks. 4. The system validates and saves updated status. 5. The constituent linked to the complaint are notified of the status change.

Alternative Flows:	**Invalid Update:** If the status change violates predefined rules, the system notifies the user and rejects the update.
Exceptions:	None
Includes:	Notify Constituents
Special Requirements:	The system should log all status changes for audit purposes.
Assumptions:	None
Notes and Issues:	Ensure notifications are timely and correctly formatted.

3.3. Functional Requirements

Users (Constituents and Representatives)

1. The system shall allow users (constituents and representatives) to register on the platform.
2. Users shall be able to log in to their accounts using valid credentials.

Constituents:

3. Constituents shall be able to report a complaint to their respective representatives through the system.
4. Constituents shall be able to track the status of their complaints.
5. Constituents shall have access to a history of their submitted complaints**.**
6. Constituents shall be able to view their representative's performance statistics, including (Total complaints received, number of complaints resolved, pending complaints, and Total meetups conducted etc)
7. Constituents shall be able to participate in surveys and polls organized by their representatives.
8. Constituents shall be able to attend virtual meetups arranged by their representatives.
9. Constituents shall be able to provide feedback on complaint resolutions and representative performance.

Representative:

10. Representatives should only register with their official email address (e.g., johndoe@na.gov.pk).

11. Representatives shall be able to create and distribute custom surveys to gather insights from constituents.
12. Representatives shall have the ability to schedule and host virtual meetings with constituents.
13. Representatives shall be able to update the status of complaints to reflect progress or resolution.
14. Representatives shall be able to forward complaints to the relevant departments for action**.**
15. Representatives shall be able to post-event calendars displaying upcoming community events and public meetings.
16. Representatives shall be able to run awareness campaigns.

Miscellaneous:

17. The system shall automatically route categorized complaints to the relevant department for efficient resolution.
18. Uncategorized complaints shall be routed to the representative for manual action.
19. The system shall notify constituents about updates on the status of their complaints and upcoming virtual meetings organized by their representatives.
20. The system shall record survey responses from participants.
21. Survey results shall be displayed using visualizations, such as charts and graphs, for easy interpretation.
22. The system should prioritize complaints containing sensitive keywords to ensure urgent issues receive prompt attention.
23. The Department Complaint Handler shall be able to update the status of complaints assigned to them, ensuring transparency and tracking.
24. The Department Complaint Handler shall be able to reroute miscategorized complaints to the appropriate representative for further action.

3.4. Non-Functional Requirements

- Each page must be loaded within 2 seconds for 95% of user interactions.
- The system should be scaled to support up to 10,000 concurrent users.

- The system must ensure 99.9% uptime availability, allowing no more than 8 hours of downtime annually.
- Complaint submission confirmation must be provided within 2 seconds.
- Sensitive user data, such as CNIC and addresses, must be encrypted using AES-256 both in transit and at rest.
- The system should support browser compatibility for the latest two versions of Chrome, Firefox, Edge, and Safari.
- The system must handle complaint routing with a response time of under 2 seconds per action.
- User sessions should time out after 30 minutes of inactivity for enhanced security.

Chapter 4: Design and Architecture

This chapter explores the design and architecture of the **Constituency Connect** system, highlighting essential principles and architectural decisions crucial for the project's success. It emphasizes the role of well-structured design in ensuring system efficiency, scalability, and user-friendliness.

It details the system's structure and architectural components, providing a blueprint for translating functional requirements into a practical and reliable solution. The discussion covers user role interactions, complaint management workflows, authentication mechanisms, and external integrations.

It also outlines the technical foundation of the project, fostering a deeper understanding of how the system efficiently manages complaint resolution, feedback mechanisms, and representative engagement, ensuring seamless public service accessibility.

4.1. System Architecture

The system follows a layered architecture, ensuring modularity, scalability, and efficient data flow. The system is structured into the following key tiers:

Presentation Layer

Business Logic Layer

Data Access Layer

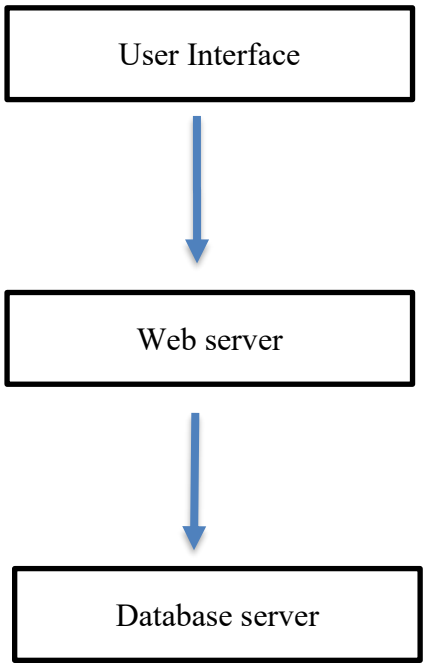

Fig 4.1: System Architecture

a. Presentation Layer (User Interface):

- This layer deals with the user interfaces, where users (constituents, representatives, and complaint handlers) interact with the system.
- Users can submit complaints, track statuses, manage events, provide feedback, and access other system functionalities.
- Ensuring a clear separation of the UI allows for an intuitive, responsive, and accessible design, even for non-technical users.

b. Business Logic Tier (Web Server):

- This layer handles the core logic of the system, including complaint processing, event management, notification handling, and user role-based access control.
- It validates complaints, categorizes them, triggers notifications, and ensures smooth communication between different roles.
- A modular service-oriented approach allows easy updates or expansions without affecting the UI or Data Layer.

c. Data Access Layer (Database Server):

- This layer is responsible for storing and managing system data, including user details, complaints, feedback, events, and notifications.
- Ensuring a separate data layer enhances security, privacy, and performance.

4.2. System Design

System design is the process of defining the structure, components, modules, and interactions within a system to ensure it meets the specified requirements. The Constituency Connect system is designed to provide an efficient, scalable, and secure platform for managing complaints, feedback, events, and communication between constituents, representatives, and complaint handlers.

This section outlines the system design, detailing key components and their interactions.

4.2.1. UML Structural Diagrams

Structural UML diagrams show how the system is structured, including the classes, objects, components, etc. in the system and the relationships between the elements.

4.2.1.1. Domain Model

The Domain Model provides a high-level conceptual representation of the system, defining key entities, their attributes, and relationships. It serves as a bridge between real-world concepts and system implementation.

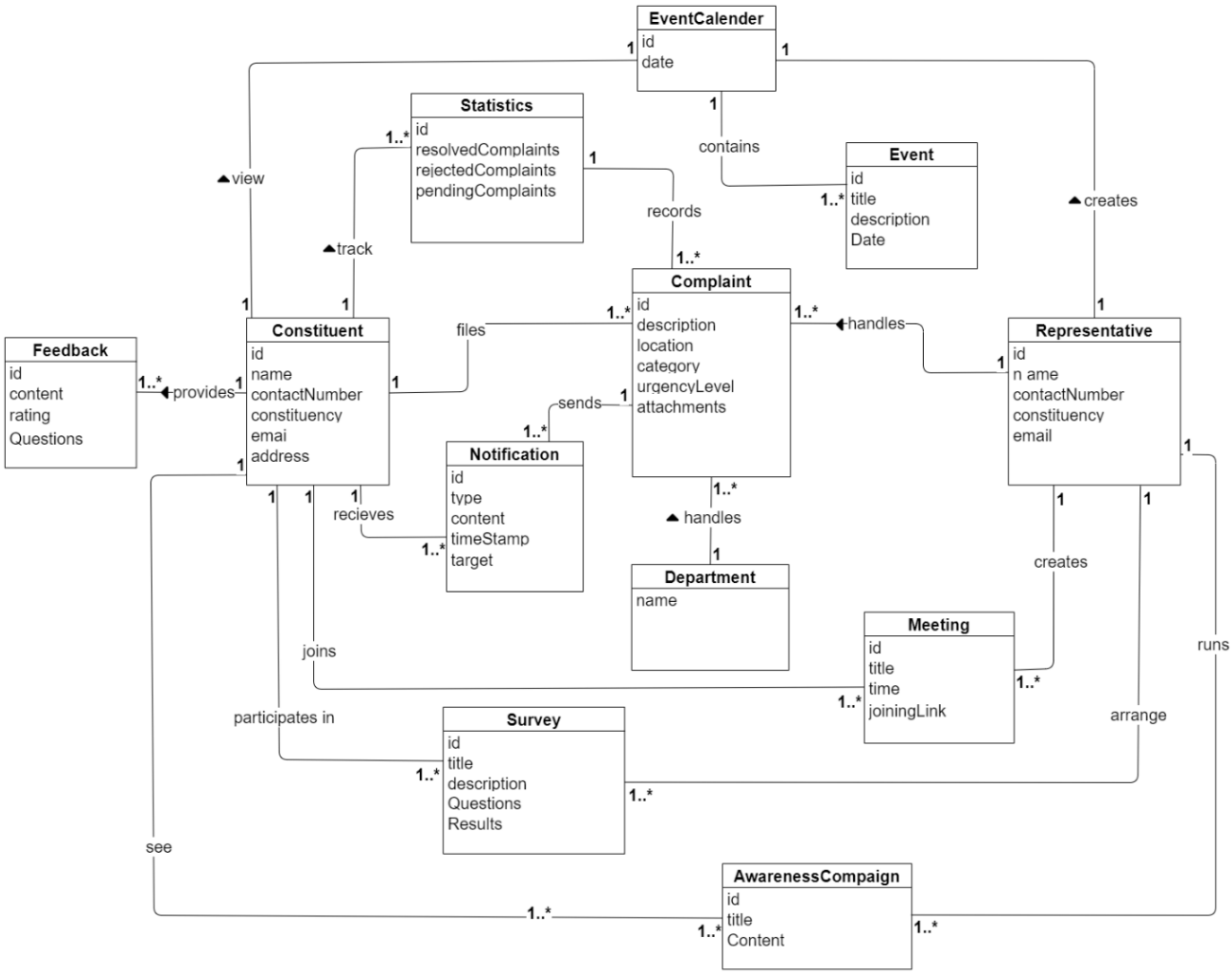

Fig 4.2: Domain Model

4.2.1.2. Class Diagram

The Class Diagram provides a detailed static view of the system by defining its classes, attributes, methods, and relationships.

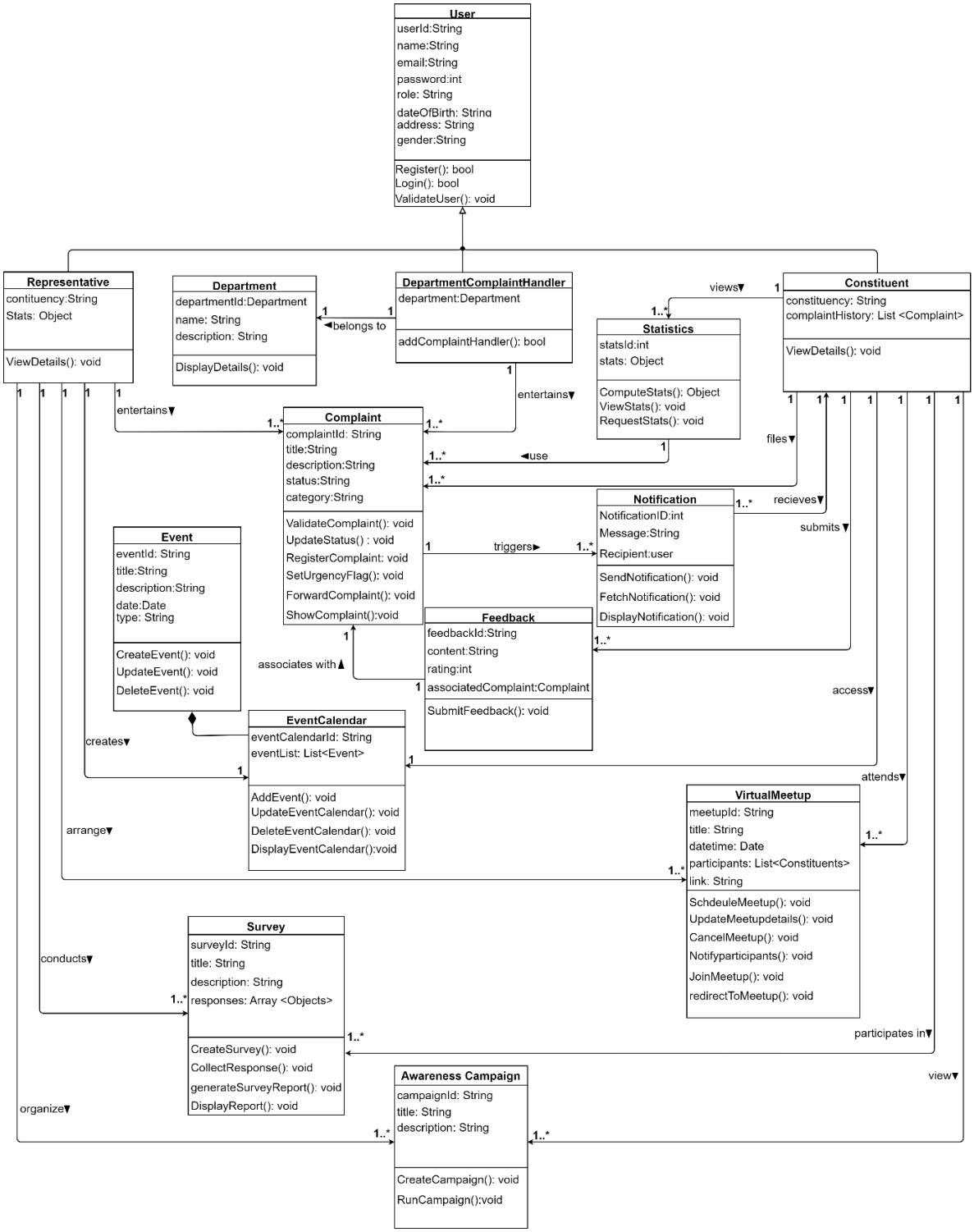

Fig 4.3: Class Diagram

4.2.1.3. Entity-Relation Diagram

Defines the data model by representing entities, their attributes, and relationships, providing a clear structure for database design and management.

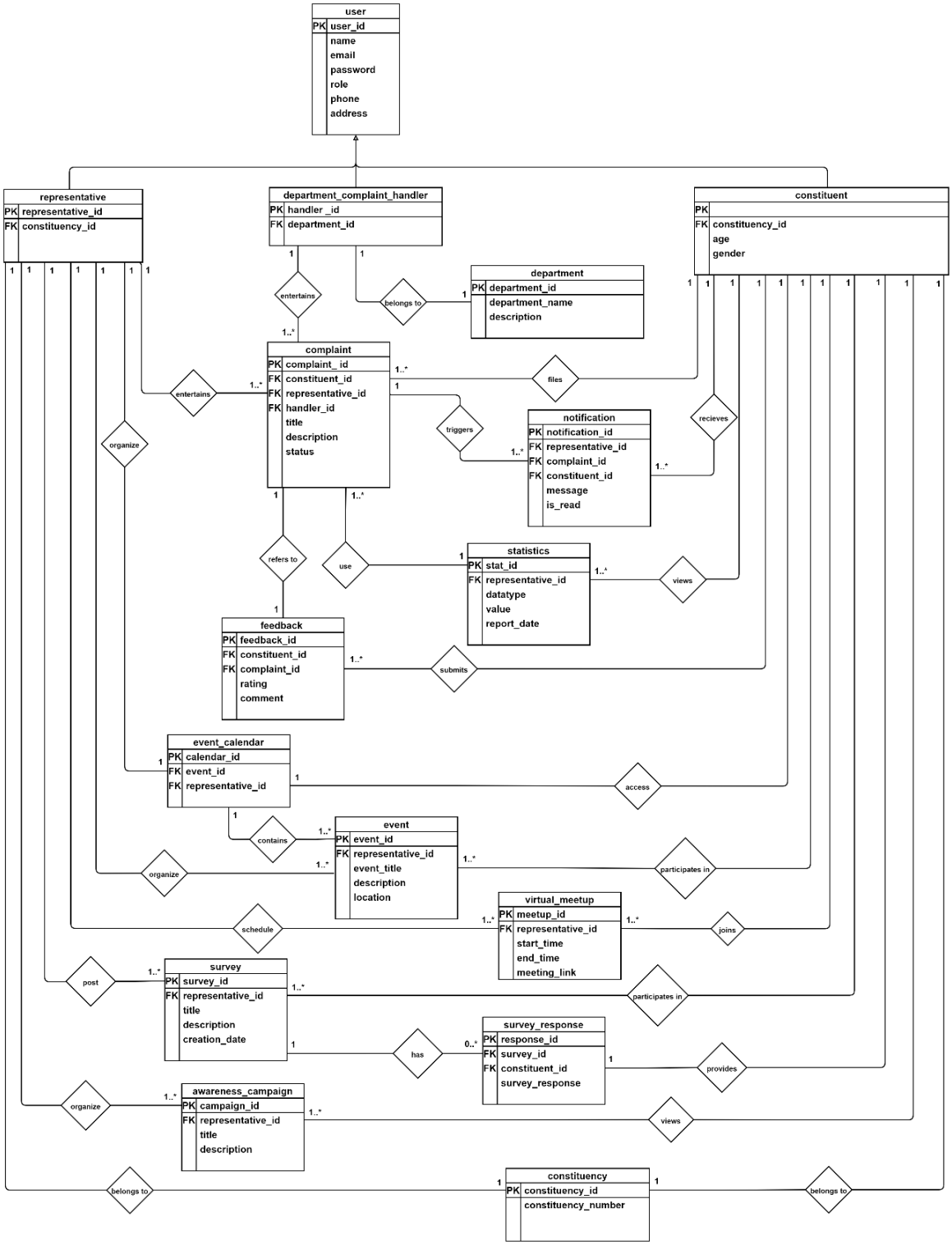

Fig 4.4: ER Diagram

4.2.2. UML Behavioral Diagrams

UML Behavioral Diagrams provide a visual representation of the system's dynamic behavior, showcasing how different components and entities interact to achieve specific tasks. These diagrams help in understanding functional workflows, message exchanges, and state transitions, ensuring a structured approach to system design and process modeling. By offering a clear view of system interactions and logic, they facilitate effective stakeholder communication and streamlined development.

4.2.2.1. Activity Diagrams

The flow of activities within a system, illustrating the sequence of actions or steps required to accomplish a specific task or behavior.

Login – Registration Activity Diagram:

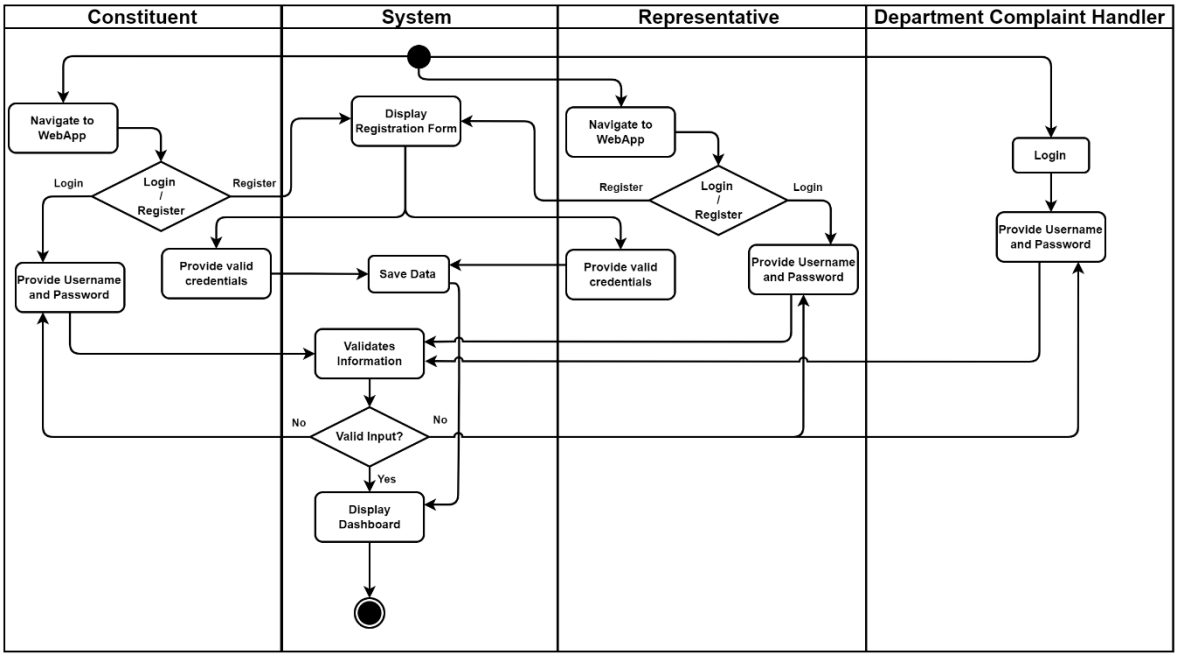

Fig 4.5: Login – Registration Activity Diagram

Complaint Resolution Activity Diagram:

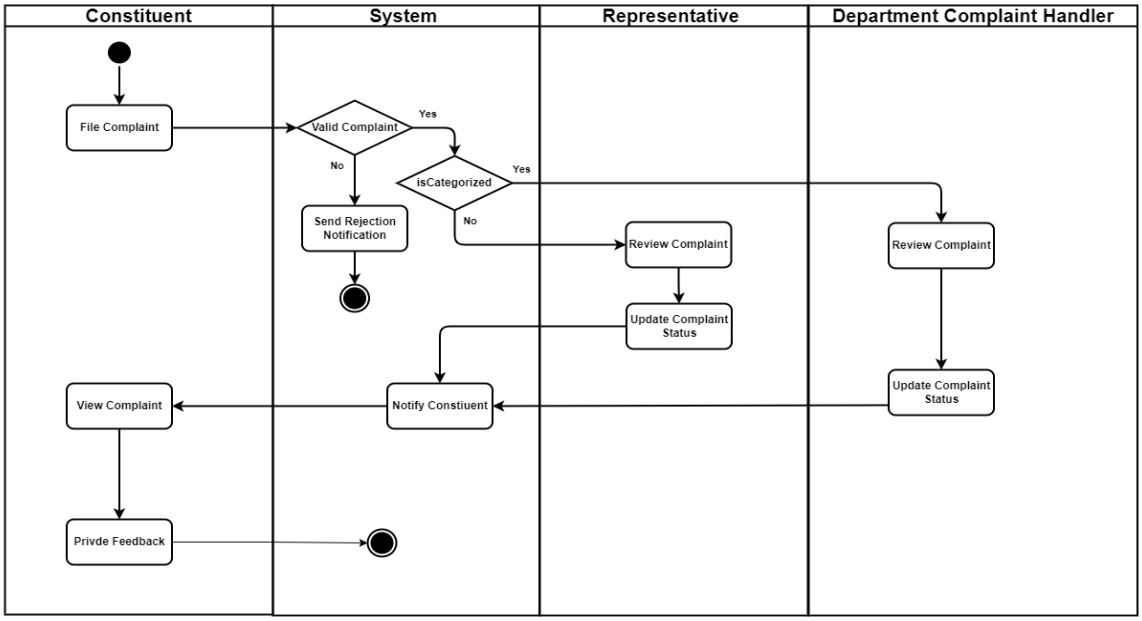

Fig 4.6: Complaint Resolution Activity Diagram

View Statistics Activity Diagram:

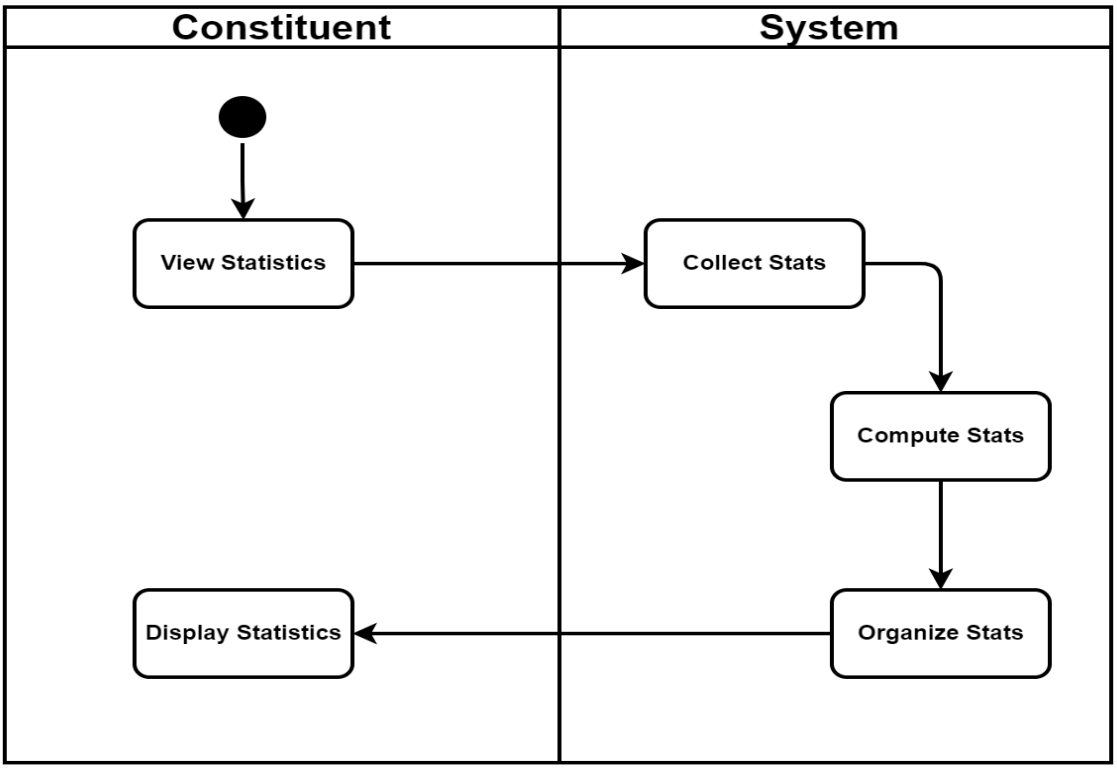

Fig 4.7: View Statistics Activity Diagram

Event Calendar Activity Diagram:

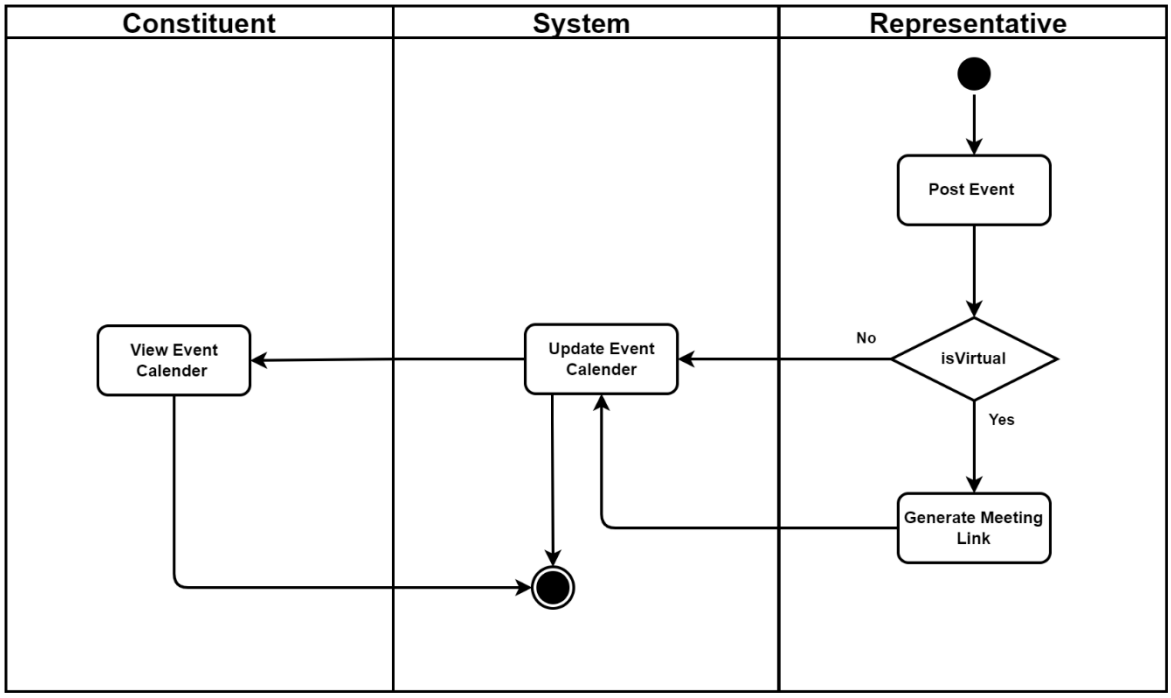

Fig 4.8: Event Calendar Activity Diagram

Survey Activity Diagram:

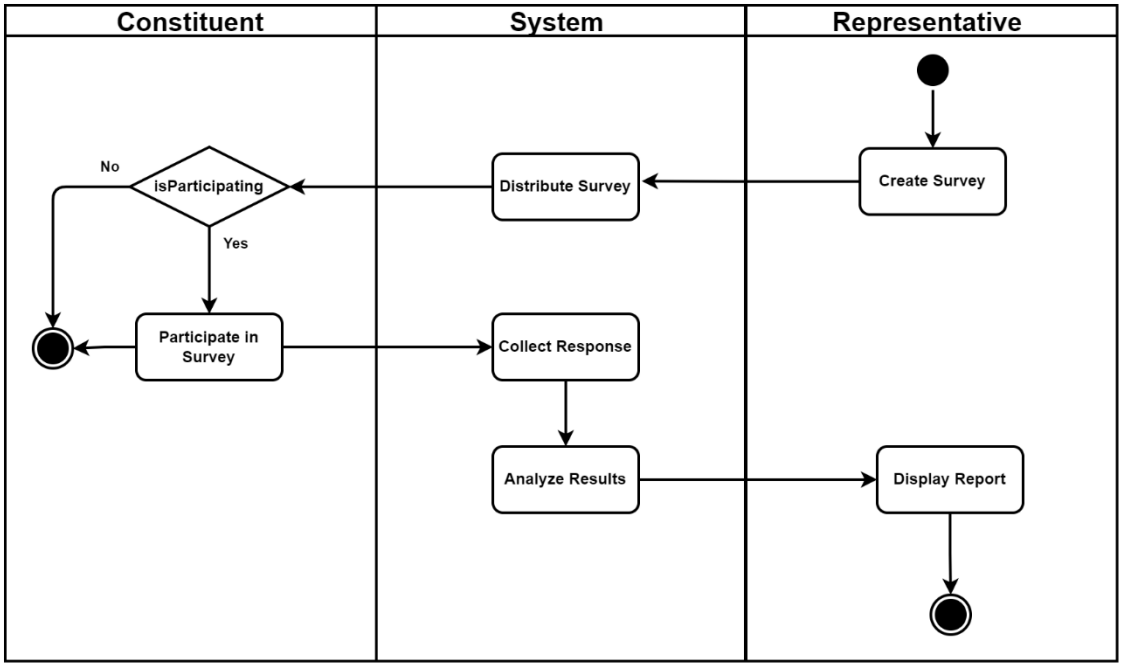

Fig 4.9: Survey Activity Diagram

4.2.2.2. State Machine Diagrams

This diagram models the behavior of individual components or objects within the system, depicting their states and transitions between them. It offers a visual representation of how the system responds to events and stimuli, guiding the understanding of its dynamic behavior.

Login – Registration State Machine Diagram:

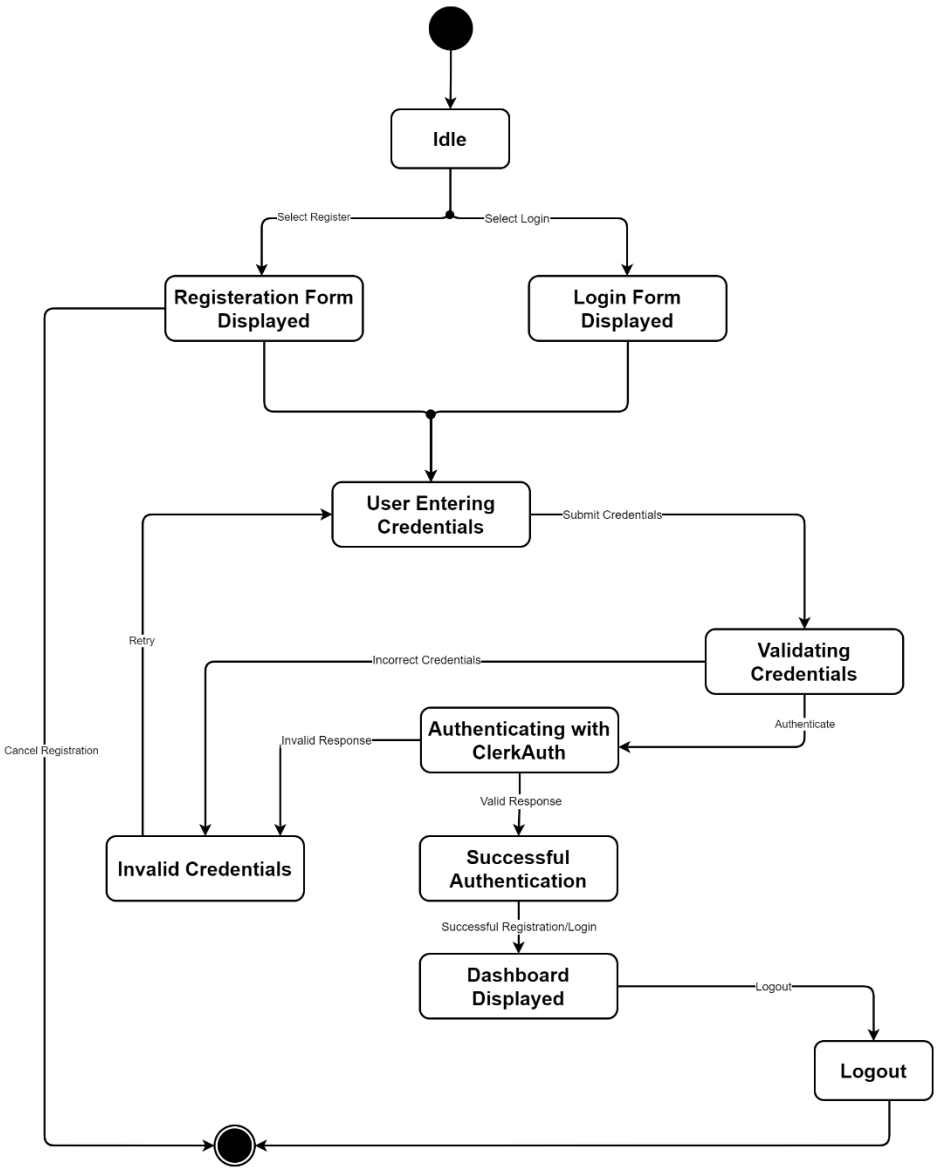

Fig 4.10: Register – Login State Machine Diagram

Complaint Resolution State Machine Diagram:

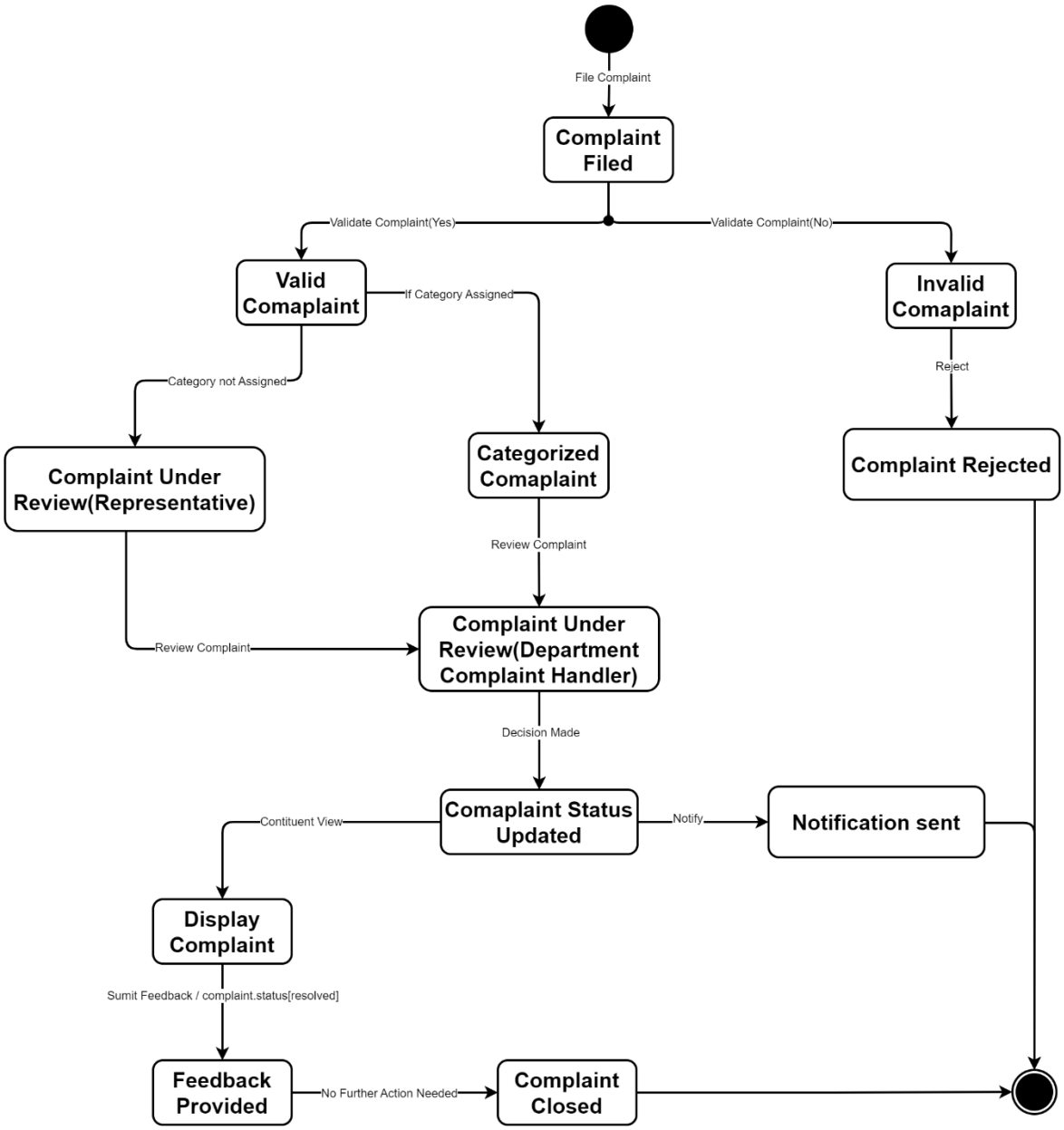

Fig 4.11: Complaint Resolution State Machine Diagram

View Statistics State Machine Diagram

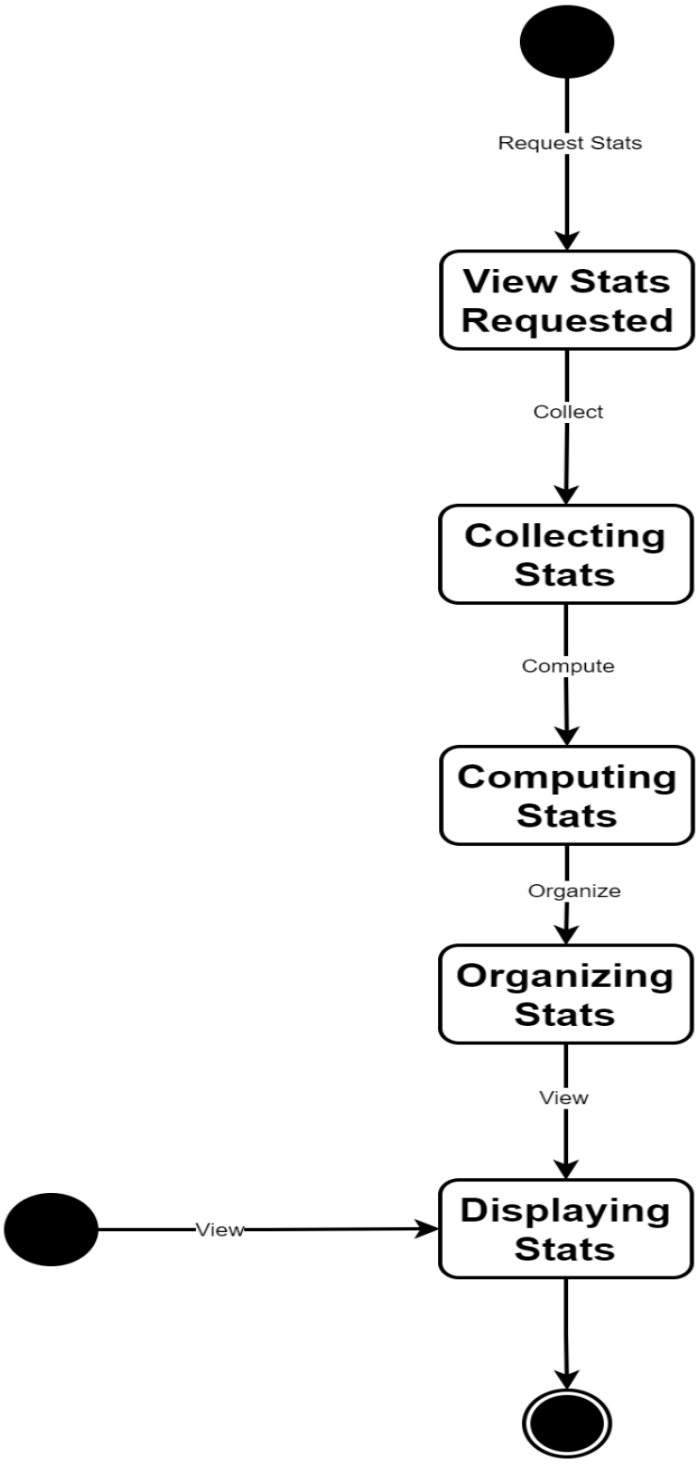

Fig 4.12: View Stats State Machine Diagram

Event Calendar State Machine Diagram:

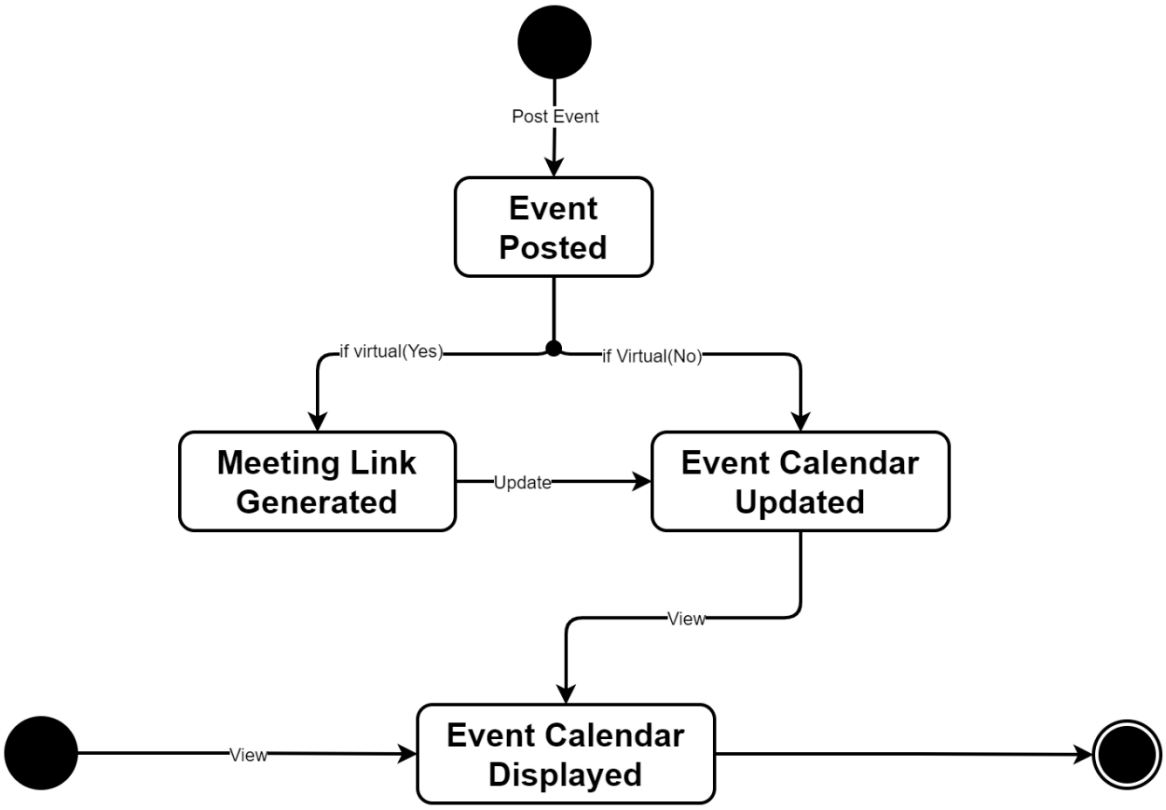

Fig 4.13: Event Calendar State Machine Diagram

Survey State Machine Diagram:

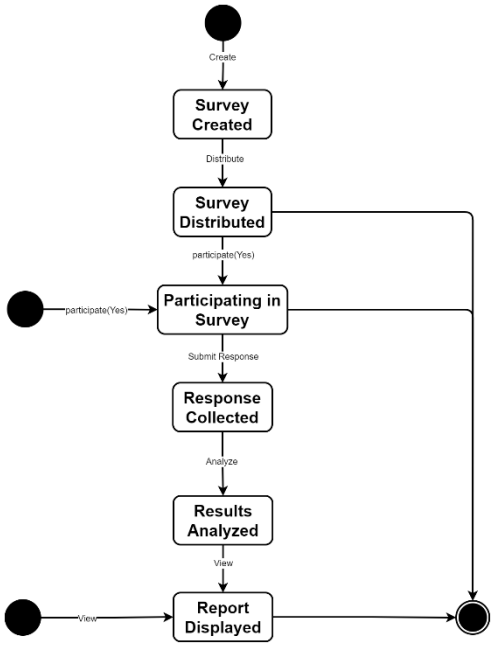

Fig 4.14: Survey State Machine Diagram

4.2.3. UML Interaction-diagrams

These diagrams detail how objects communicate in response to events, focusing on message exchanges between system components.

4.2.3.1. System Sequence Diagrams

It Shows how the system interacts with external actors in a sequence of operations.

Submit Complaint System Sequence Diagram

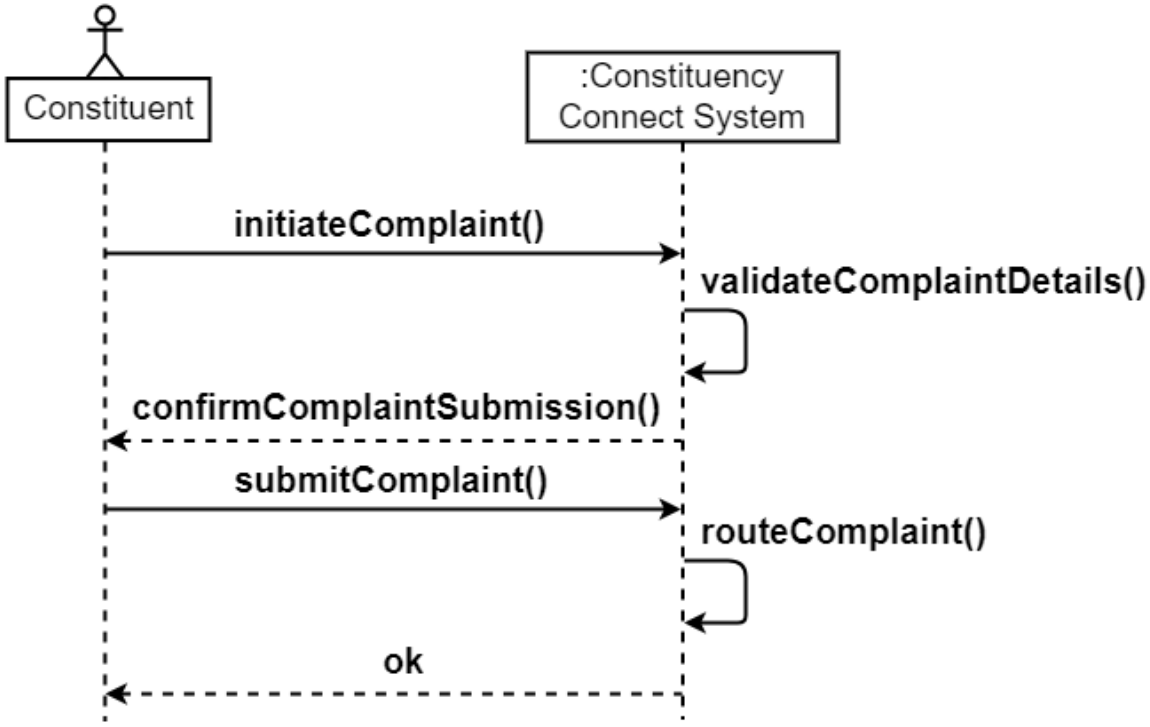

Fig 4.15: Submit Complaint System Sequence Diagram

Track Complaint Status System Sequence Diagram

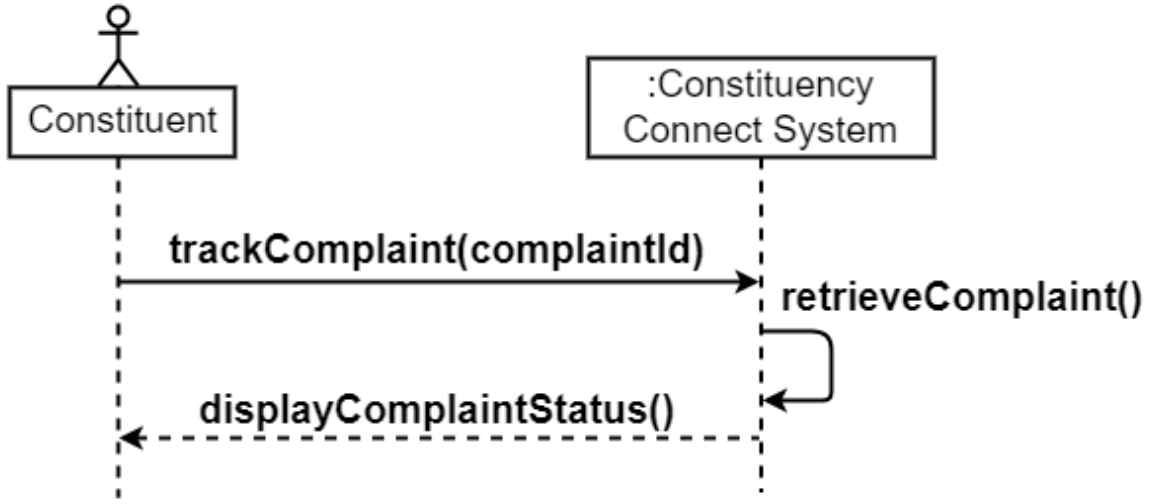

Fig 4.16: Track Complaint Status System Sequence Diagram

Track Complaint History System Sequence Diagram

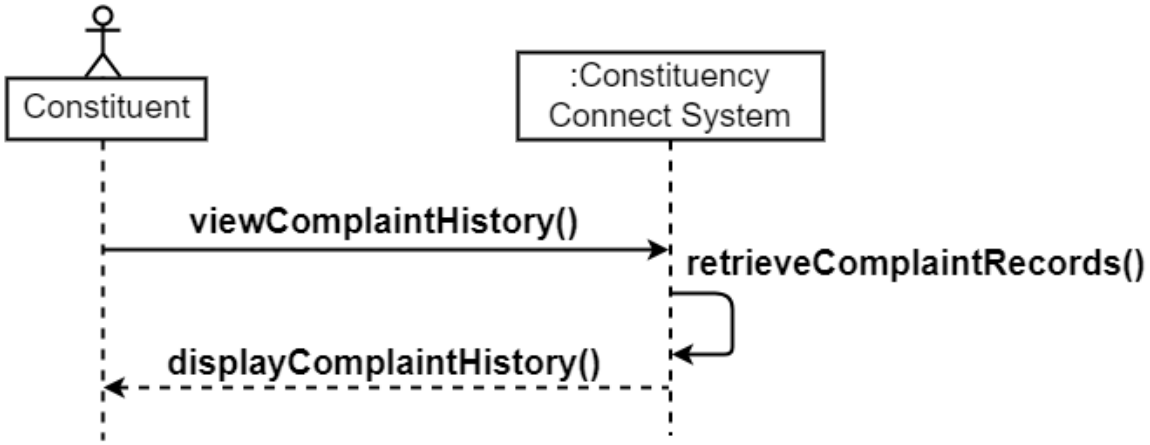

Fig 4.17: Track Complaint History System Sequence Diagram

View Representative Stats System Sequence Diagram

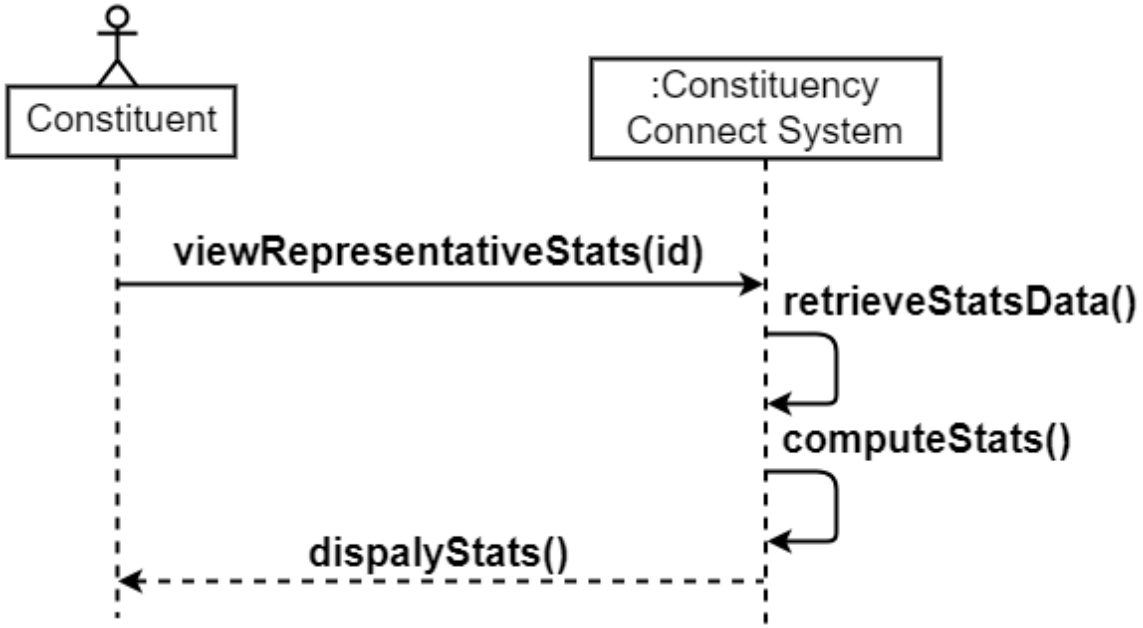

Fig 4.18: View Representative Stats System Sequence Diagram

Survey Participation System Sequence Diagram

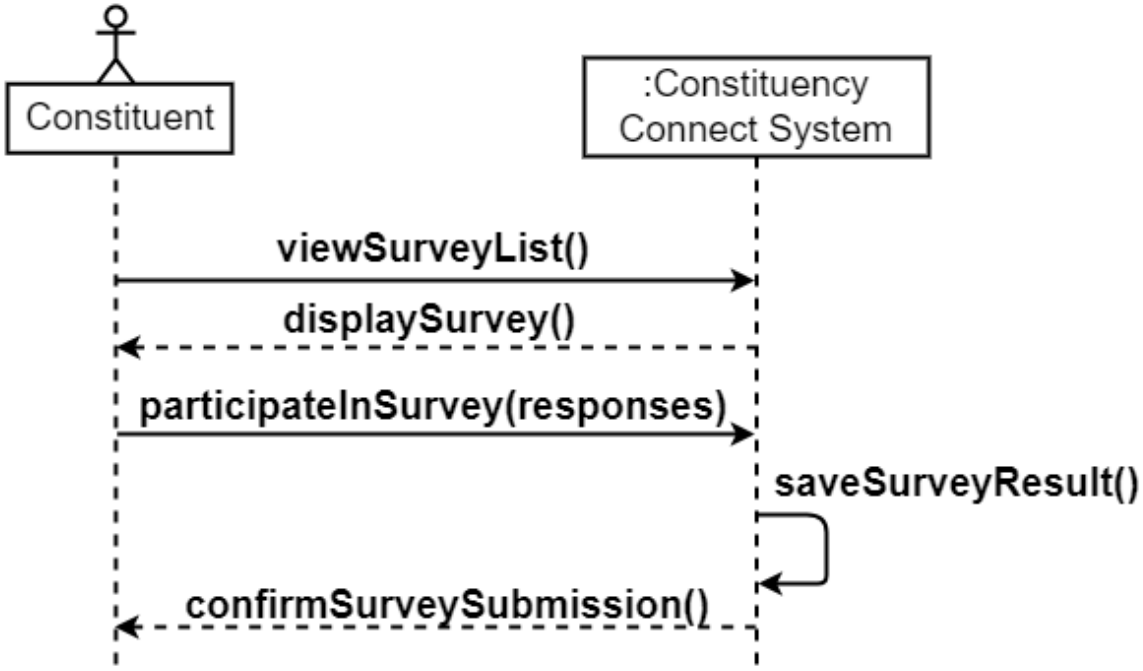

Fig 4.19: Survey Participation System Sequence Diagram

Provide Feedback System Sequence Diagram

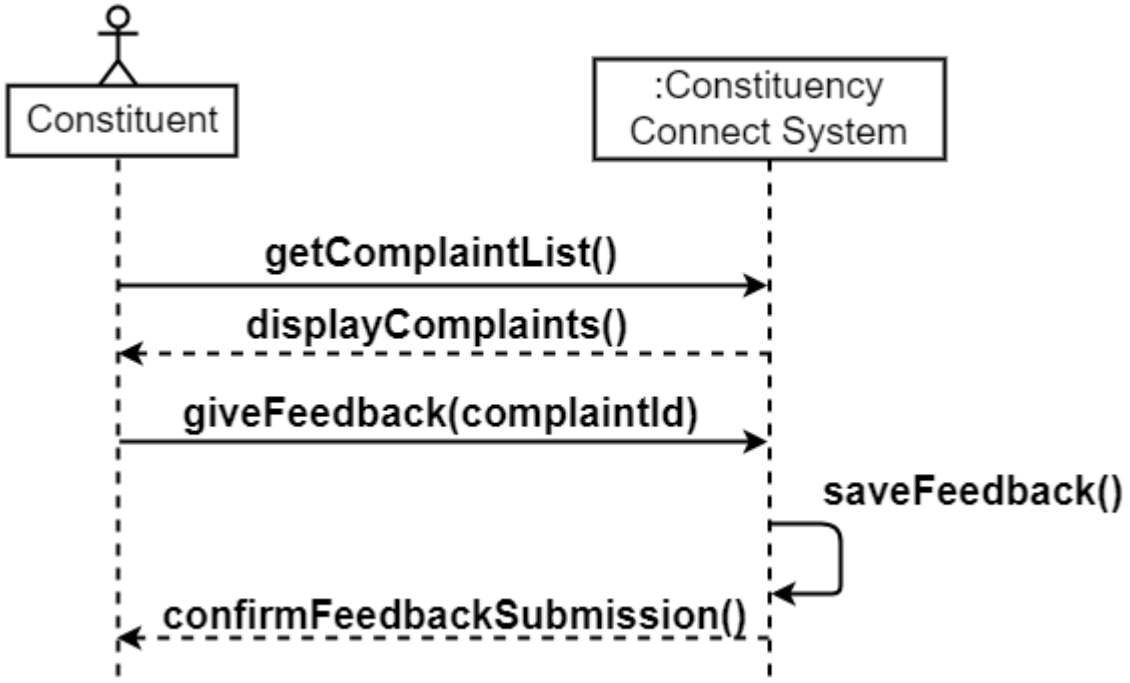

Fig 4.20: Provide Feedback System Sequence Diagram

Display Campaign System Sequence Diagram

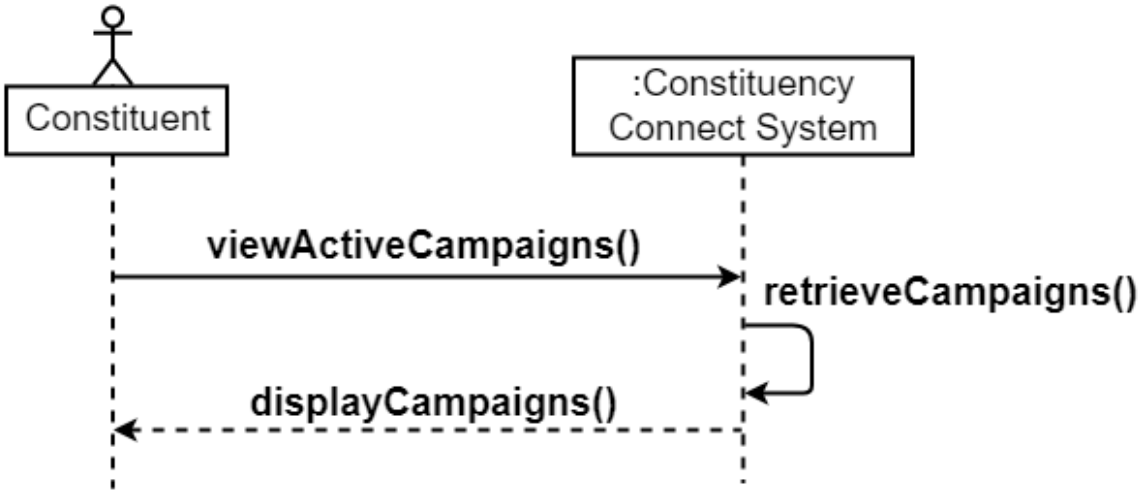

Fig 4.21: Display Campaign System Sequence Diagram

Display Event Calendar System Sequence Diagram

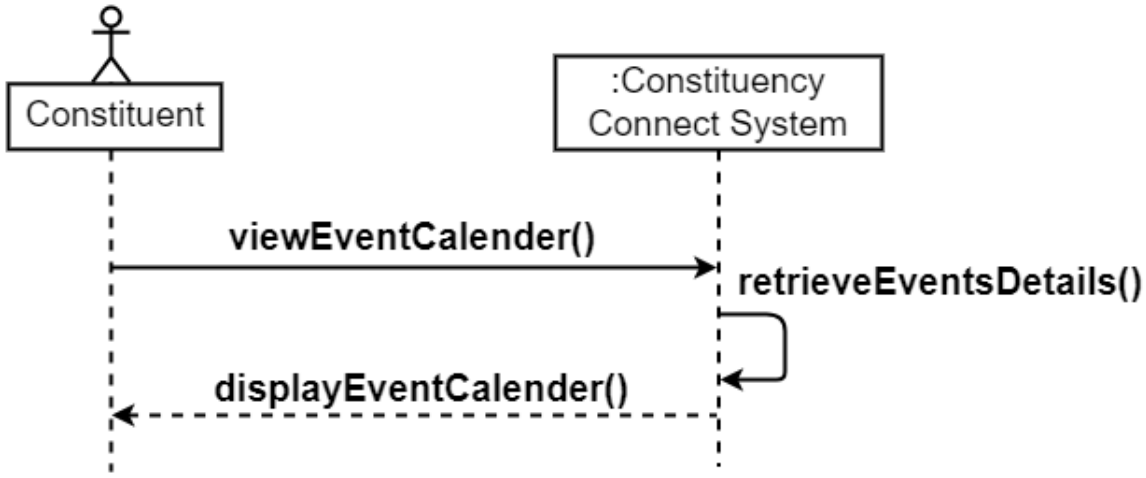

Fig 4.22: Display Event Calendar System Sequence Diagram

Join Virtual Meetup System Sequence Diagram

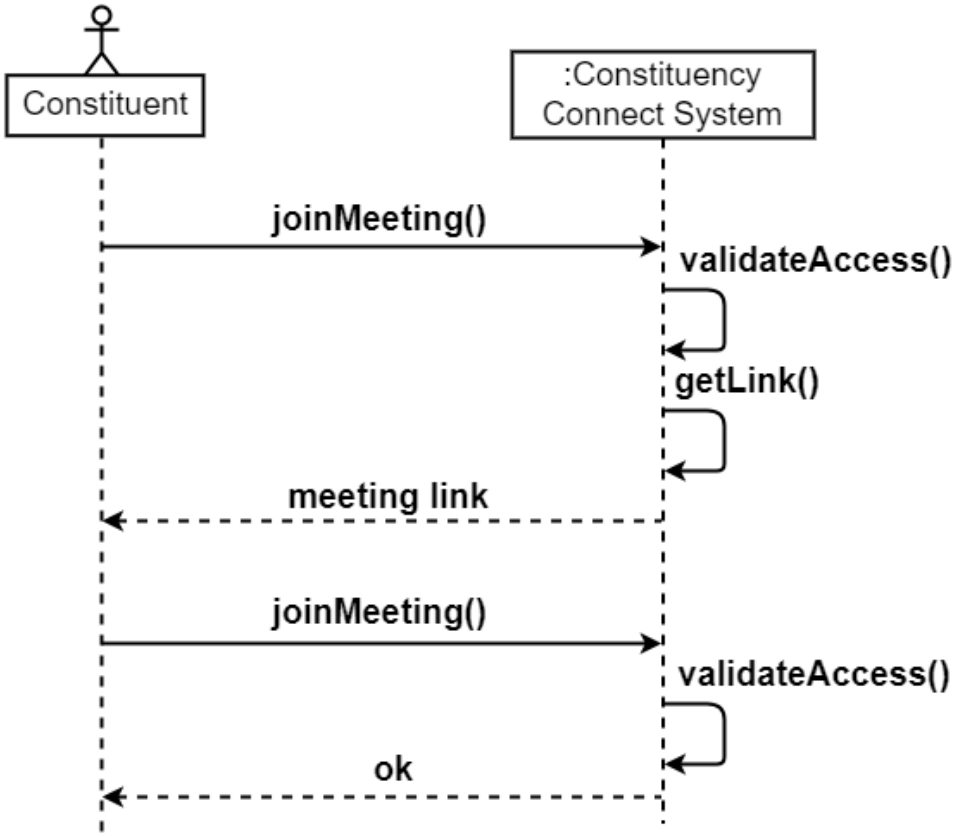

Fig 4.23: Join Virtual Meetup System Sequence Diagram

Create Survey System Sequence Diagram

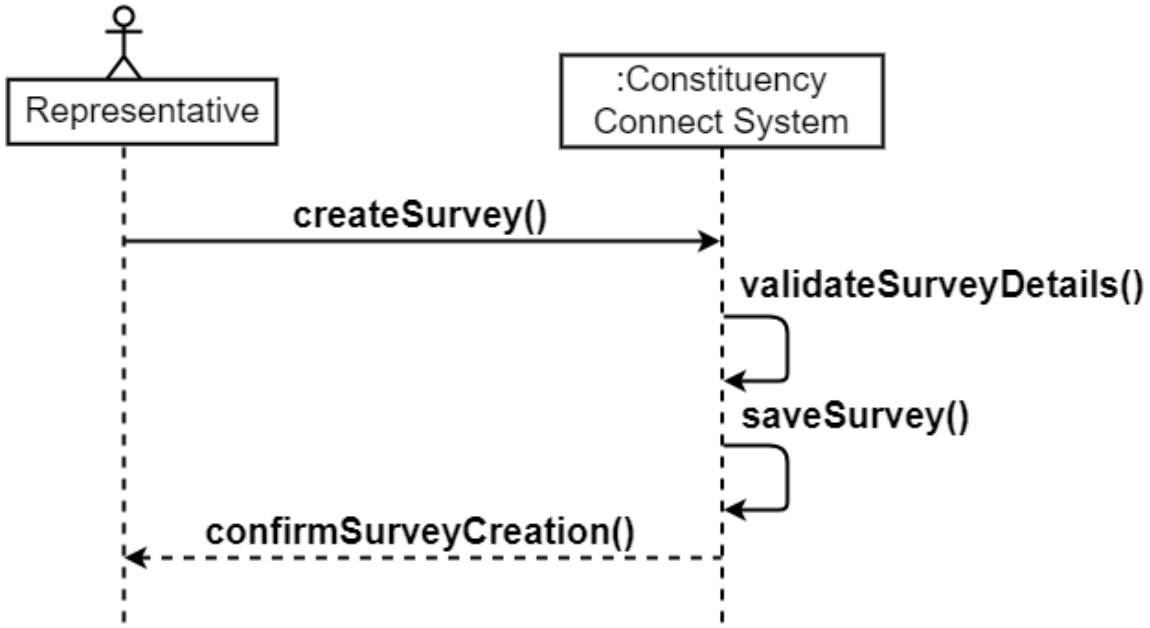

Fig 4.24: Create Survey System Sequence Diagram

Compute Survey Result System Sequence Diagram

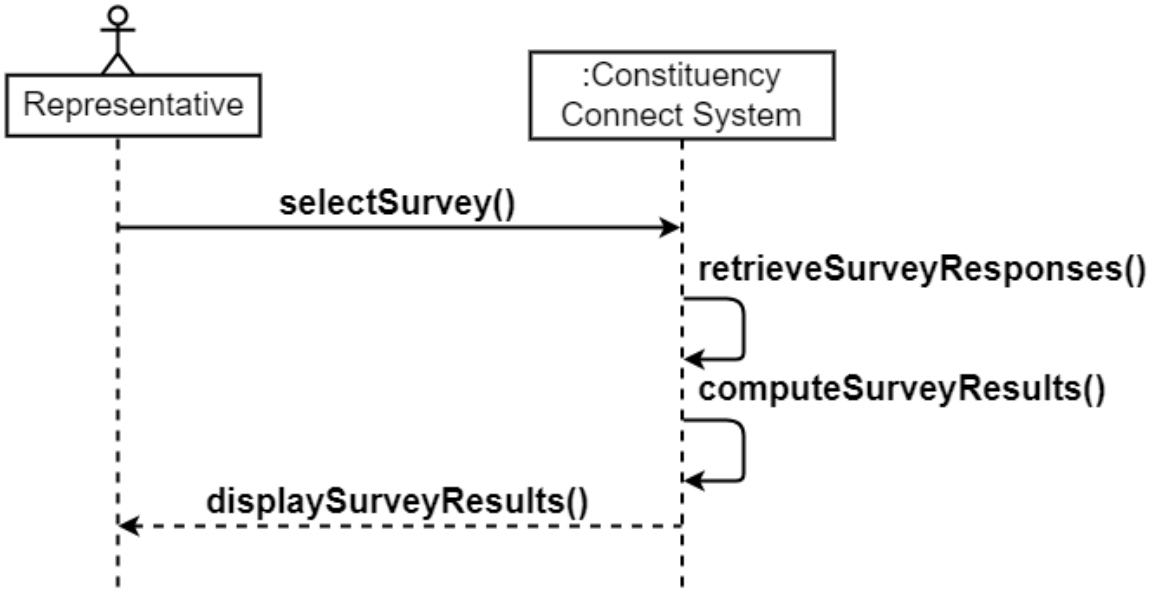

Fig 4.25: Compute Survey Result System Sequence Diagram

Post Event Calendar System Sequence Diagram

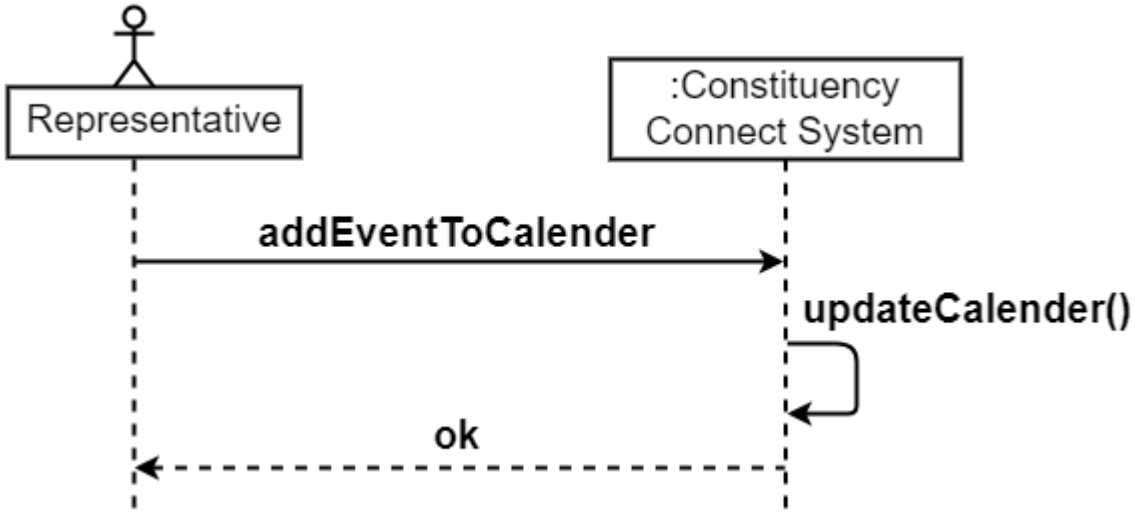

Fig 4.26: Post Event Calendar System Sequence Diagram

Post Awareness Campaign System Sequence Diagram

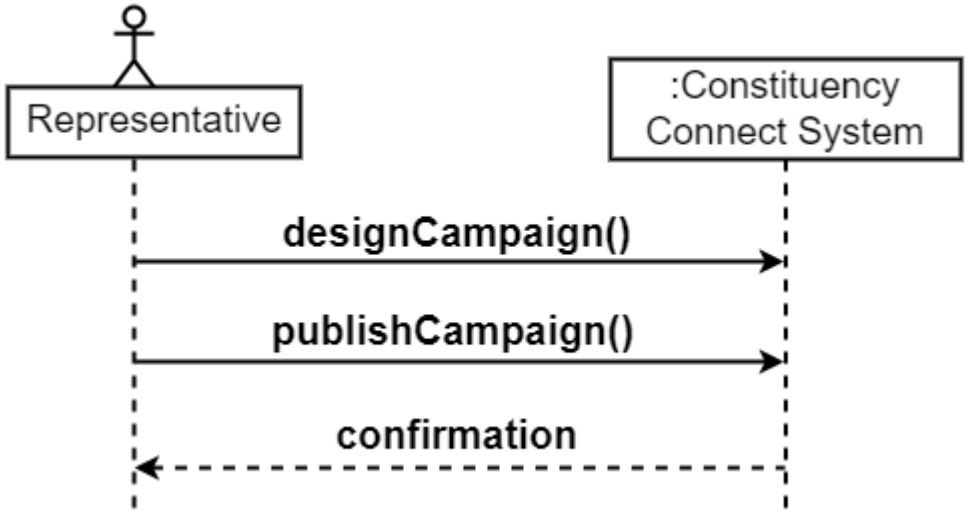

Fig 4.27: Post Awareness Campaign System Sequence Diagram

View Complaint System Sequence Diagram

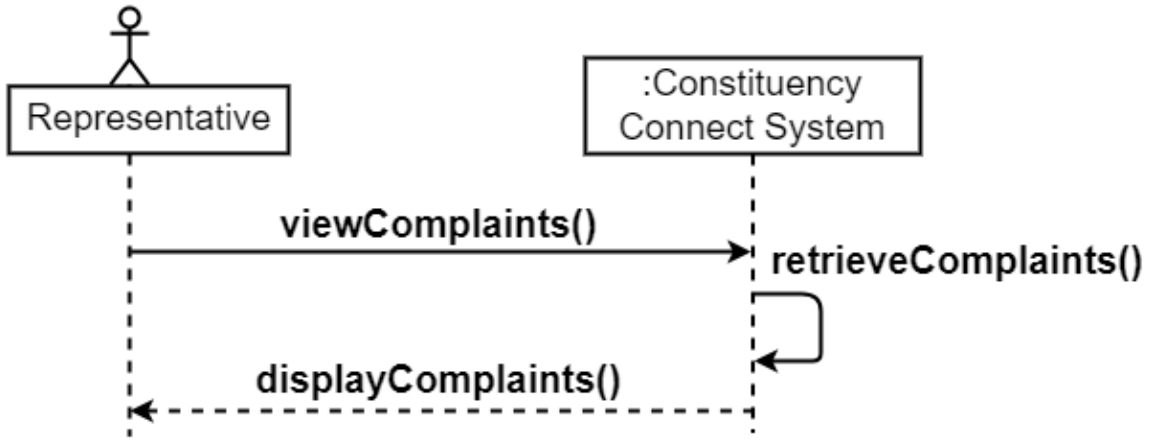

Fig 4.28: View Complaint System Sequence Diagram

Update Complaint Status System Sequence Diagram

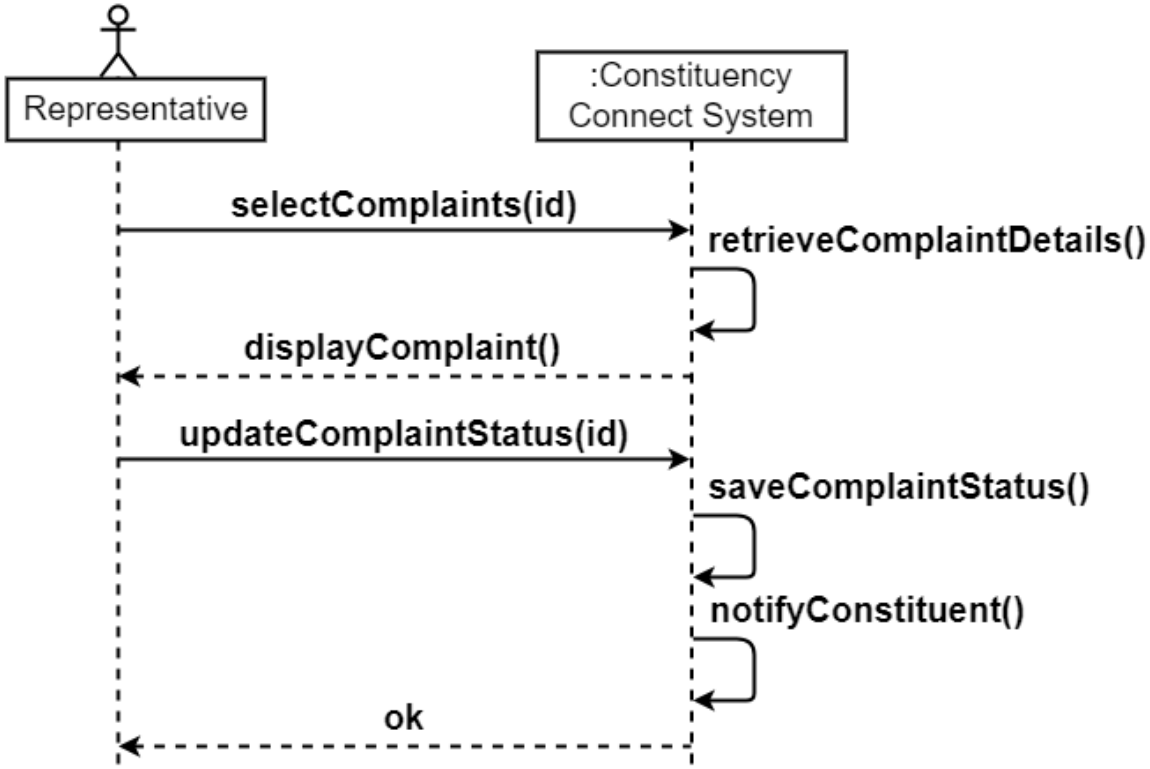

Fig 4.29: Update Complaint Status System Sequence Diagram

Arrange Virtual Meetup System Sequence Diagram

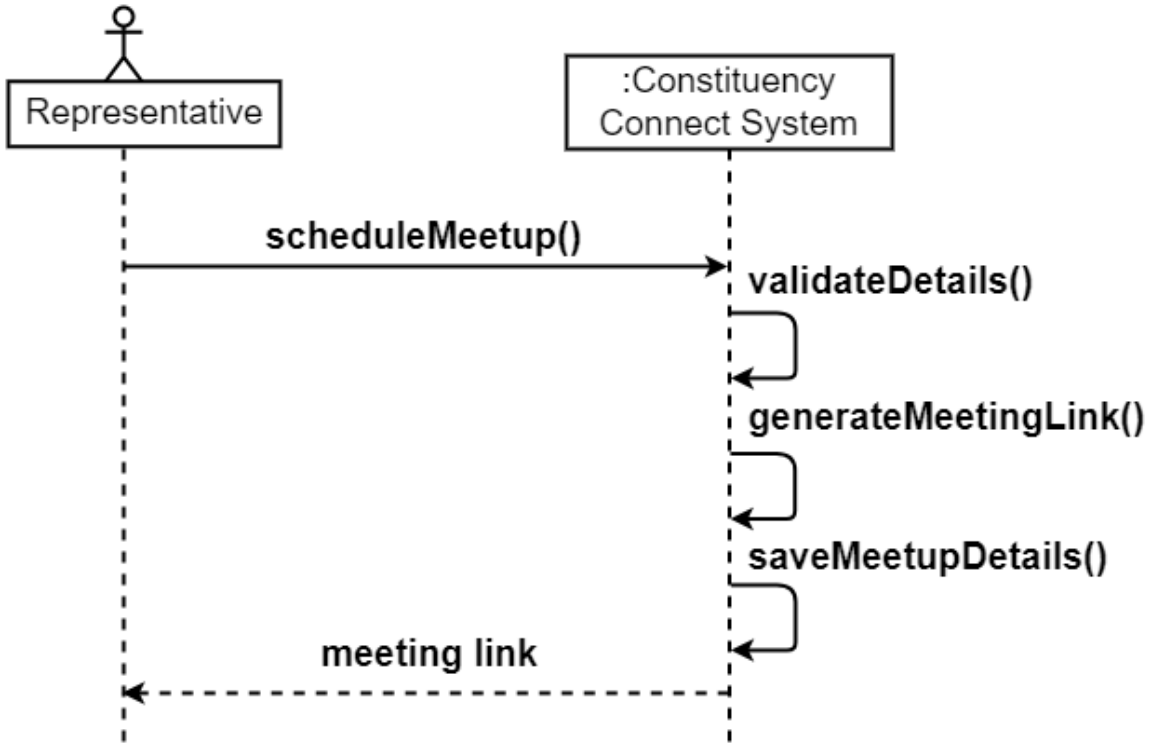

Fig 4.30: Arrange Virtual Meetup System Sequence Diagram

4.2.3.2. Sequence Diagrams

It represents the step-by-step flow of interactions between objects in a sequence**.**

Signup Sequence Diagram

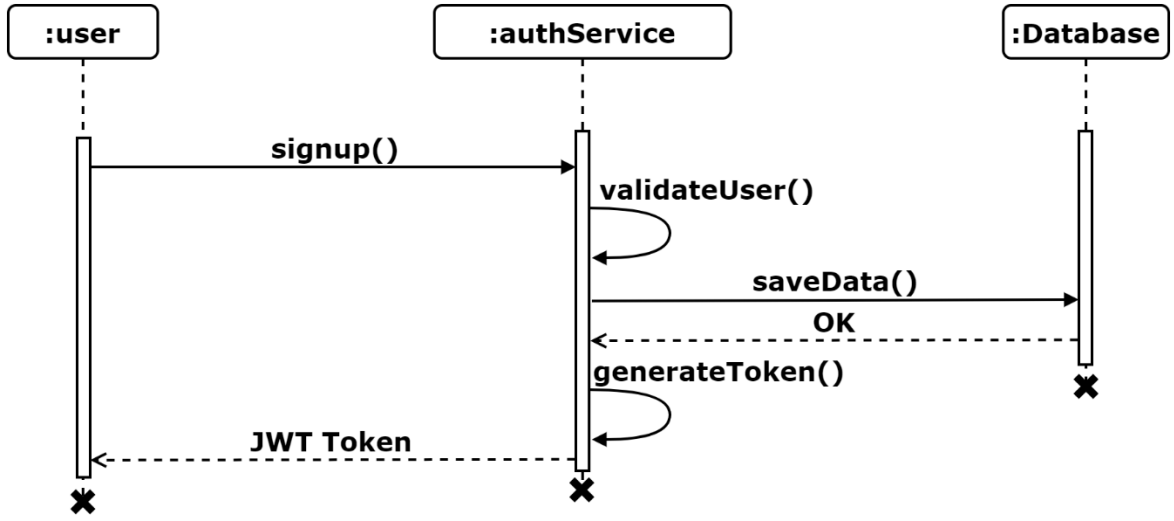

Fig 4.31: Signup Sequence Diagram

Login Sequence Diagram

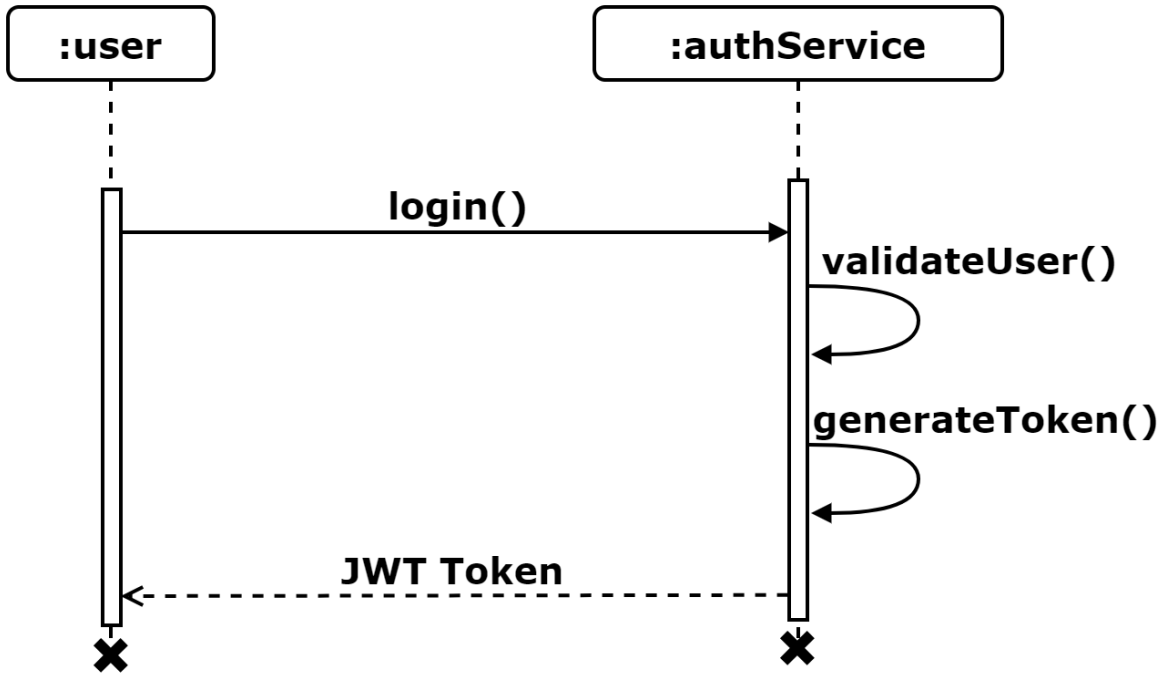

Fig 4.32: Login Sequence Diagram

Complaint Resolution Sequence Diagram

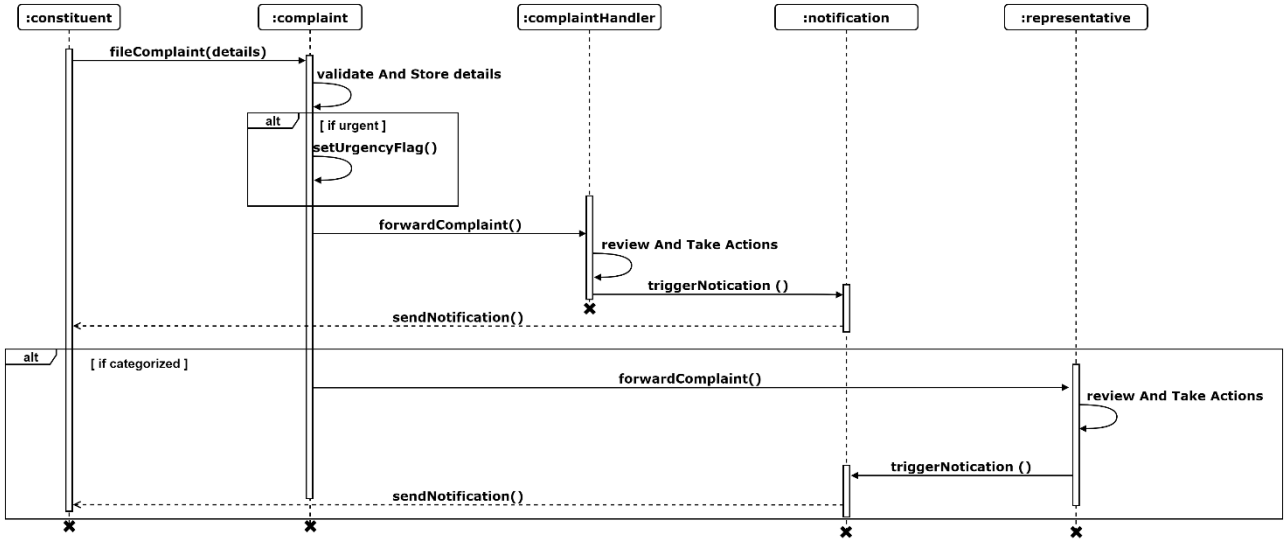

Fig 4.33: Complaint Resolution Sequence Diagram

Submit Feedback Sequence Diagram

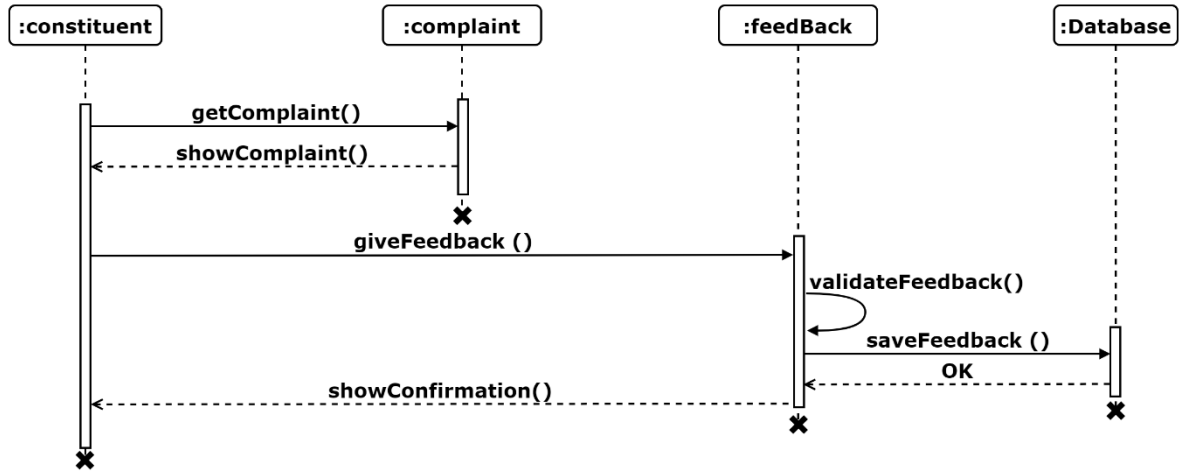

Fig 4.34: Submit Feedback Sequence Diagram

Post an Event Sequence Diagram

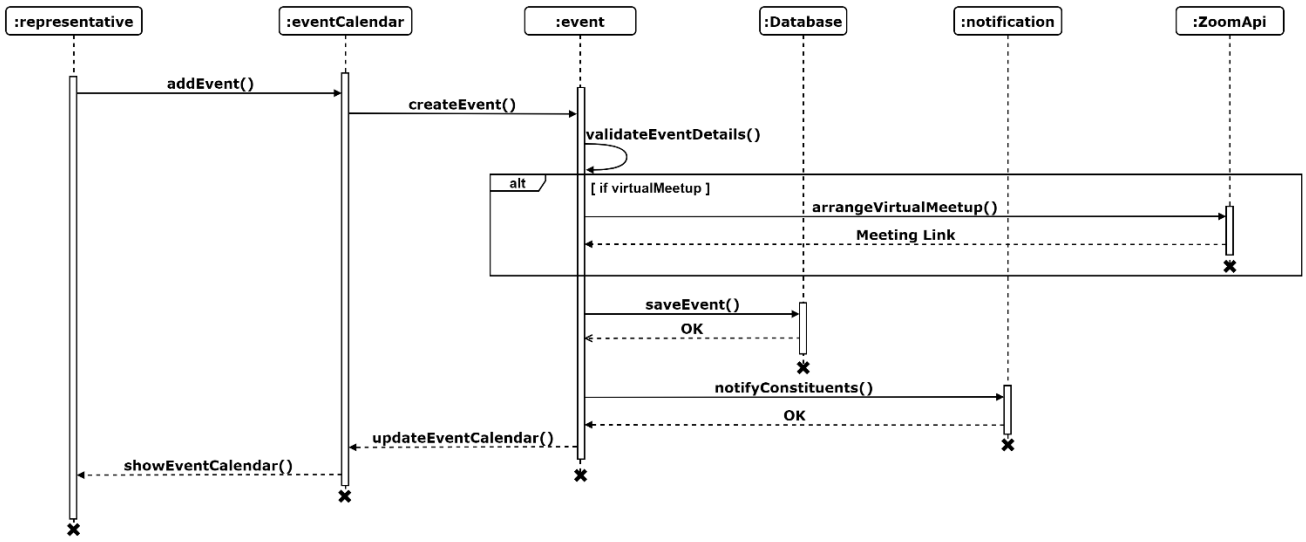

Fig 4.35: Post an Event Sequence Diagram

Join Virtual Meetup Sequence Diagram

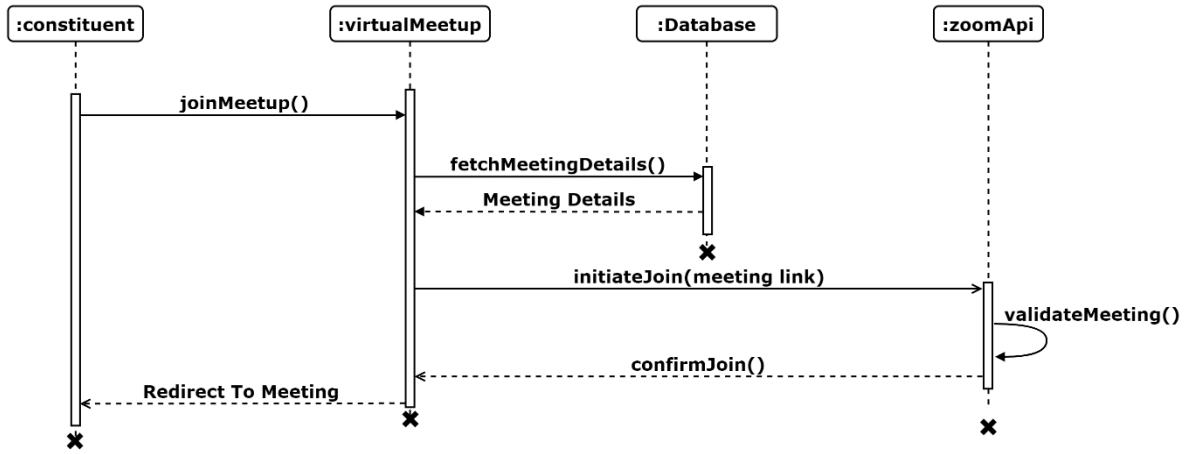

Fig 4.36: Join Virtual Meetup Sequence Diagram

Post Virtual Meetup Sequence Diagram

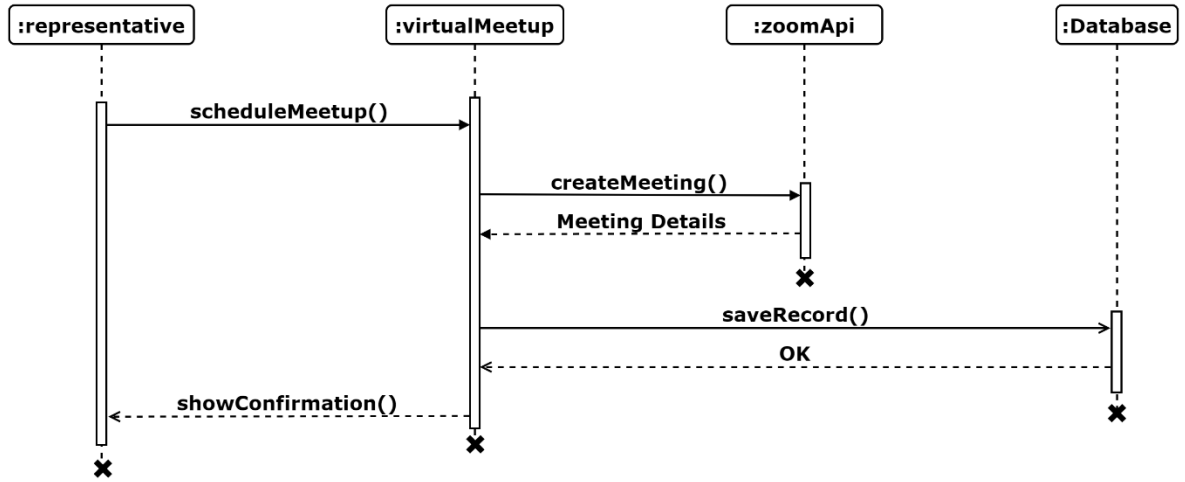

Fig 4.37: Post Virtual Meetup Sequence Diagram

Create Awareness Campaign Sequence Diagram

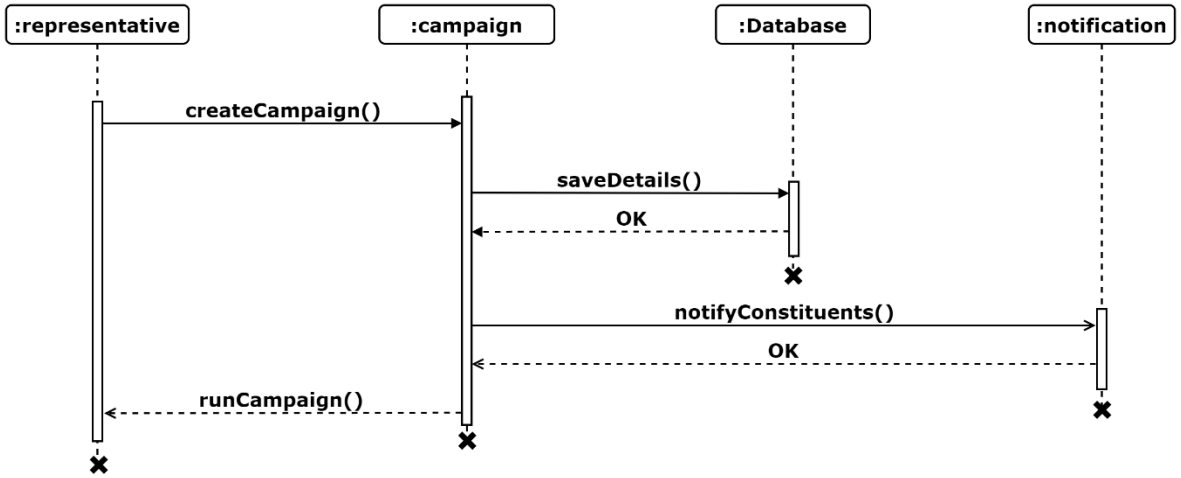

Fig 4.38: Create Awareness Campaign Sequence Diagram

View Notification Sequence Diagram

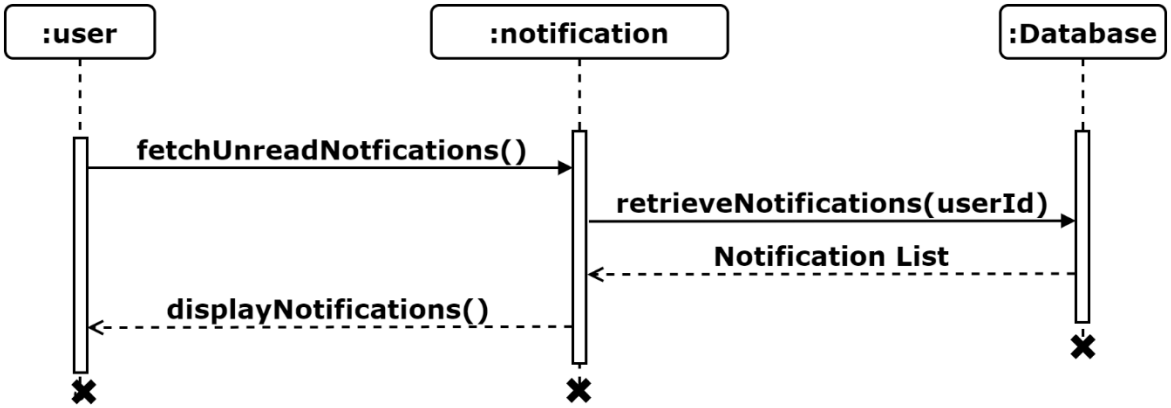

Fig 4.39: View Notification Sequence Diagram

View Stats Sequence Diagram

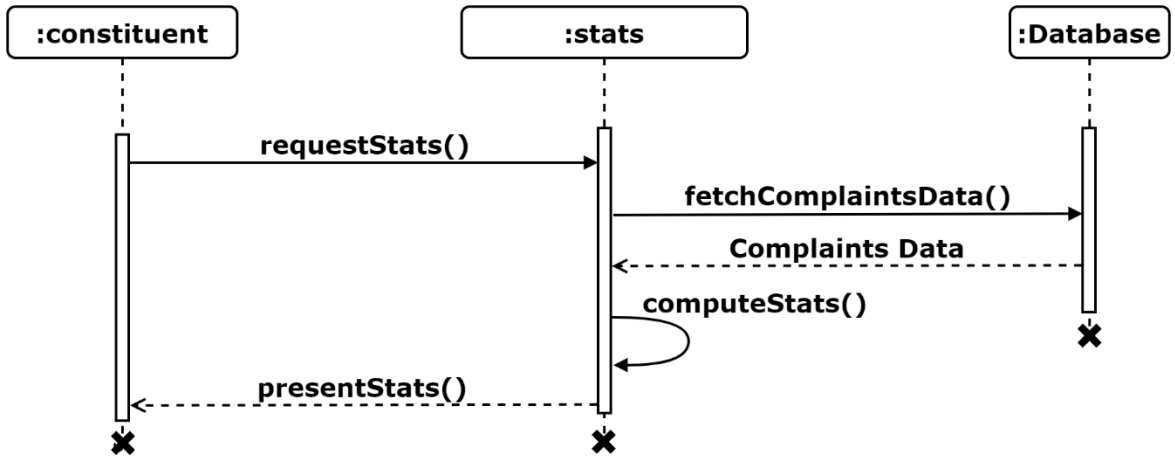

Fig 4.40: View Stats Sequence Diagram

Analyze Survey Sequence Diagram

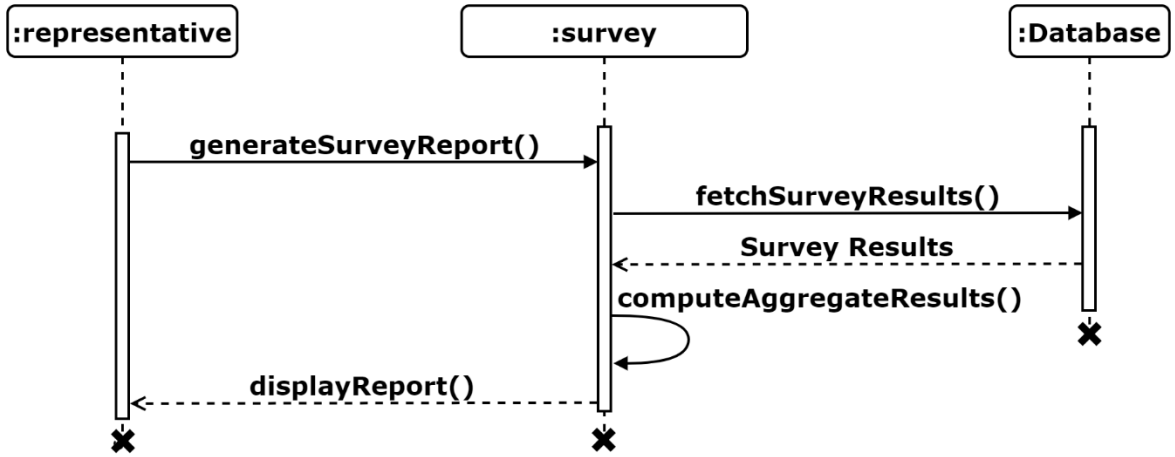

Fig 4.41: Analyze Survey Sequence Diagram

View Complaint Sequence Diagram

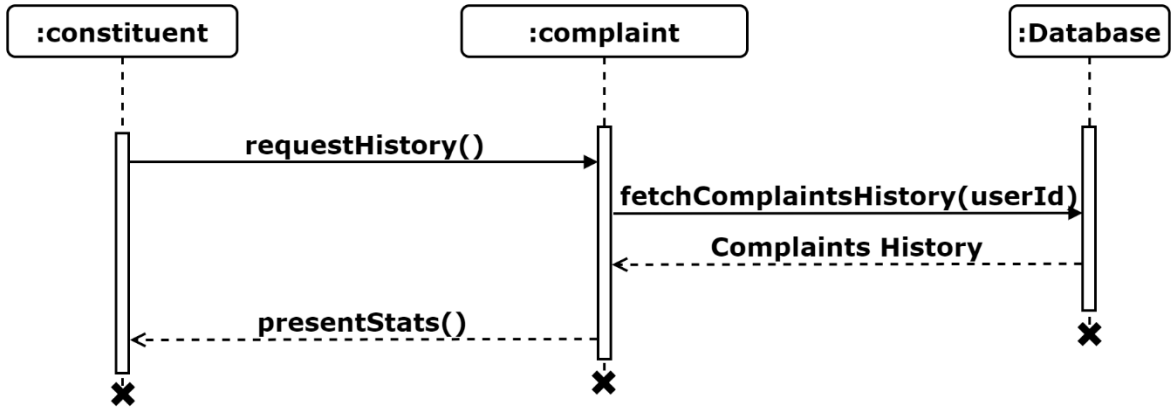

Fig 4.42: View Complaint Sequence Diagram

Survey Participation Sequence Diagram

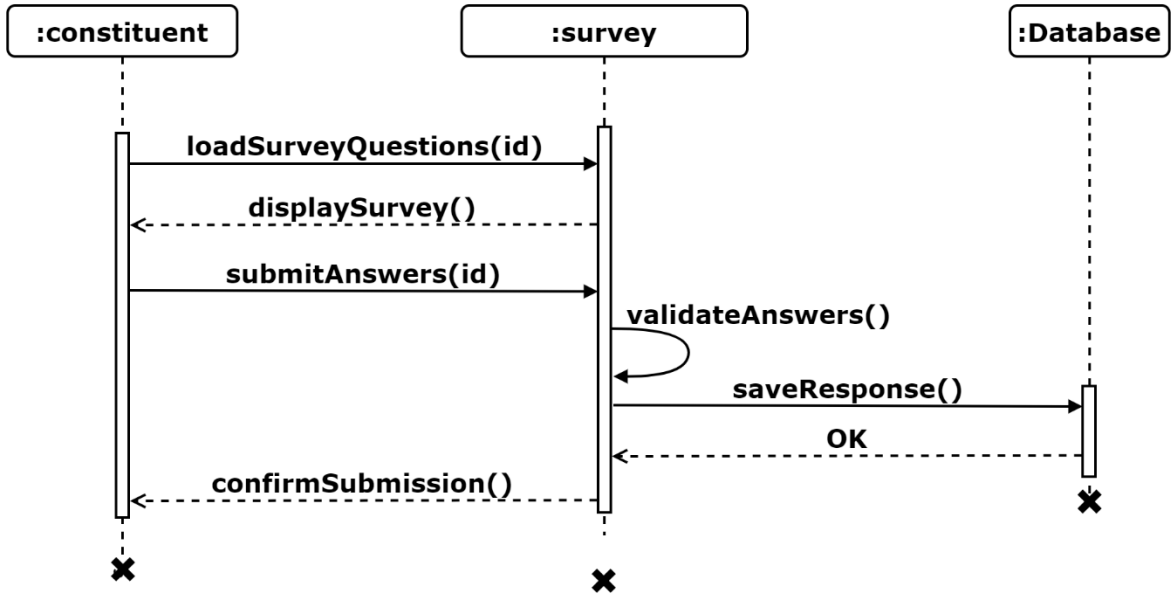

Fig 4.43: Survey Participation Sequence Diagram

4.2.4. Node Structure

Node Structure defines the arrangement and organization of nodes within a network or system architecture, specifying their connectivity, relationships, and communication flow. It establishes the foundation for data transmission, processing, and interaction between different system components, ensuring efficient performance, scalability, and reliability.

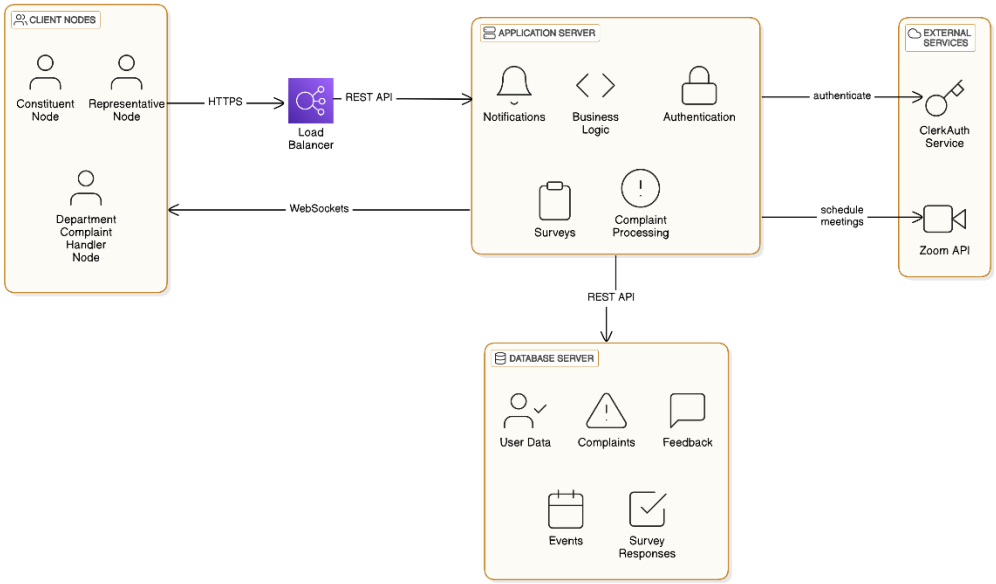

Fig 4.44: Node Structure Diagram

Chapter 5: Implementation

This chapter provides a comprehensive insight into the architecture, component interactions, network structure, and user interaction mechanisms employed in the Constituency Connect System. It outlines the component diagram, node and deployment structure, interface definitions, and system behavior, presenting a holistic view of how different parts of the application work together.

5.1. Component Diagram

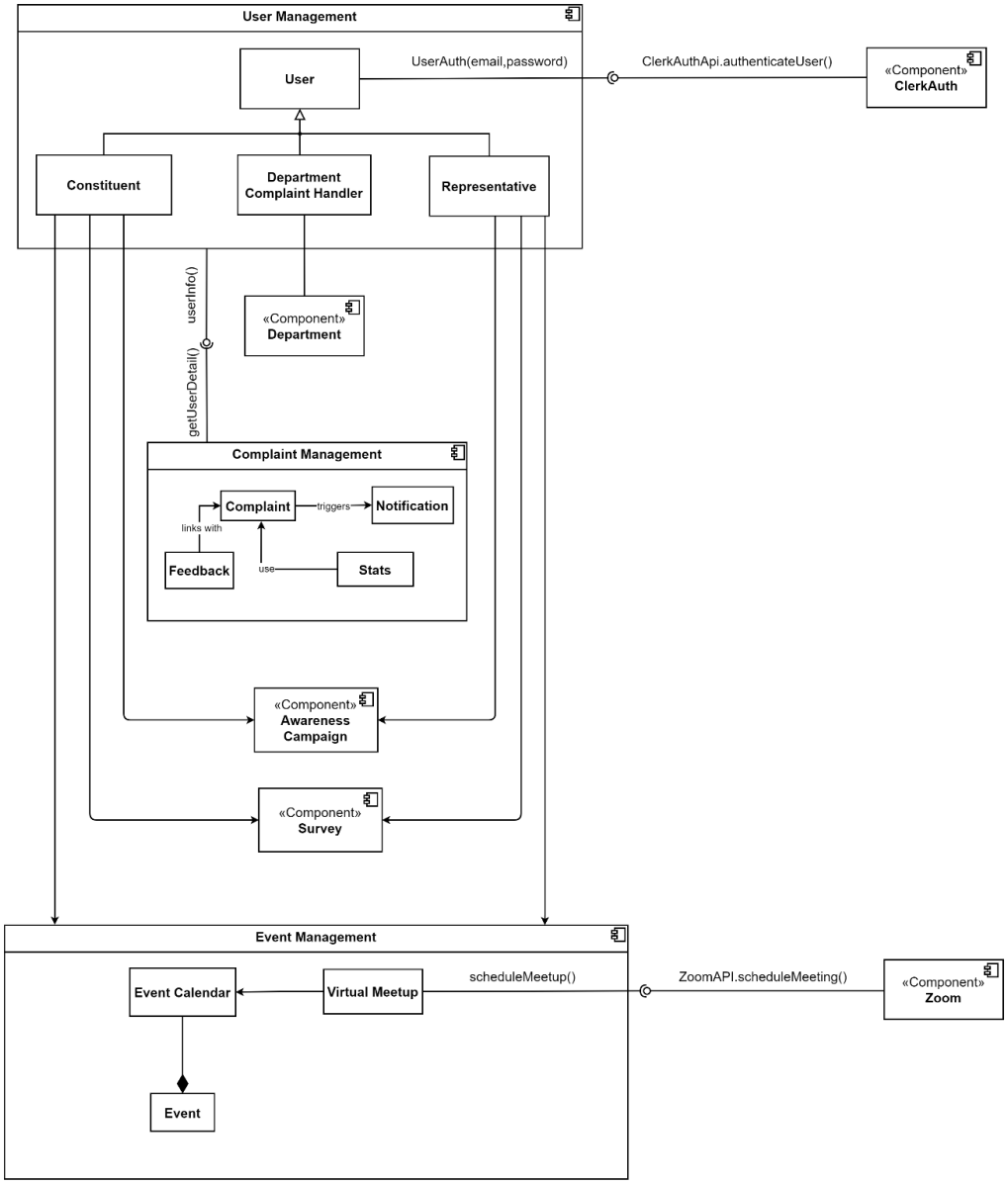

Fig 5.1: Component Diagram

5.1.1. User Management Component

The User Management Component ensures seamless registration, authentication, and role management across the platform. It facilitates secure login, role-based access control, and integration with third-party authentication services like JWT for enhanced security and scalability.

- **User Authentication:** Users (constituents, representatives, department complaint handlers) authenticate securely using email and password credentials through the JWT tokens.
- **Role-Based Access:** After authentication, users access features specific to their roles, ensuring relevant functionality and data visibility.
- **Secure User Data Management:** User profiles, including demographic and official information, are securely stored and managed through robust backend systems.

5.1.2. Complaint Management Component

The Complaint Management Component streamlines the handling, tracking, and resolution of constituent complaints. It acts as the core system feature to ensure citizen grievances are addressed efficiently.

- **Complaint Submission and Tracking:** Constituents can submit detailed complaints with categories, urgency levels, and attachments, and track status updates in real-time.
- **Notification Triggering:** Upon complaint submission or status change, users and relevant handlers receive system-generated notifications for timely updates.
- **Feedback Collection:** Users can provide feedback on complaint resolution quality, helping the system gather valuable service insights.
- **Statistical Analysis (Stats):** Data from complaints and feedback is aggregated to generate visual stats, helping representatives and departments improve service delivery.

5.1.3. Awareness Campaign Component

The Awareness Campaign Component allows representatives to create and promote campaigns aimed at addressing public concerns, spreading vital information, or announcing community initiatives.

- **Campaign Creation and Publishing:** Representatives can initiate awareness campaigns that constituents can view and engage with.
- **Campaign Management:** Campaign progress and responses are tracked to measure effectiveness and citizen outreach.

5.1.4. Survey Component

The Survey Component enables representatives and administrators to collect structured feedback from constituents, guiding decision-making and public service improvement.

- **Survey Creation:** Officials can build surveys tailored to specific topics like public needs or satisfaction levels.
- **Survey Participation:** Constituents can respond to surveys, contributing their perspectives directly to governance planning.
- **Data-Driven Insights:** Aggregated survey responses help in analyzing constituent priorities and service gaps.

5.1.5. Event Management Component

The Event Management Component facilitates scheduling and managing both physical and virtual public events, ensuring better communication between officials and the public.

- **Virtual Meetup Scheduling:** Representatives can host virtual meetings using integrated video conferencing platforms like Zoom.
- **Event Calendar:** All upcoming events are published to an accessible calendar, allowing constituents to stay informed about important sessions and town halls.
- **Event Details Access:** Constituents can view event information, join sessions, and receive reminders, ensuring high participation rates.

5.2. Network and Protocol Choice

The Constituency Connect system adopts robust network and communication protocols to ensure secure, reliable, and scalable interactions between the frontend and backend components. By utilizing HTTPS, RESTful APIs, and JSON for data exchange, the system achieves high compatibility, data integrity, and enhanced user experience across its modules.

- **Network Protocol:** The system employs HTTP (Hypertext Transfer Protocol) for all communications, ensuring encrypted data transmission between the user interface (web clients) and backend servers.
- **Communication Protocol:** RESTful APIs (Representational State Transfer) serve as the primary communication method between the frontend and backend. This approach provides a uniform interface, simplifies client-server interactions, and supports stateless operations, enhancing the scalability and maintainability of the system.
- **Data Exchange Format:** JSON (JavaScript Object Notation) is used as the standard format for data exchange. JSON's lightweight, easy-to-parse structure ensures fast and efficient transmission of complaint data, appointment details, notifications, and user feedback between the frontend and backend services.

5.3. Choice of Object Middleware

In the Constituency Connect system, selecting appropriate object middleware is critical to ensure efficient, scalable, and secure interaction between the frontend and backend layers. A RESTful API architecture, implemented using Express.js on the Node.js backend, has been chosen as the middleware solution.

RESTful APIs offer a standardized and lightweight communication mechanism, enabling the frontend (built with modern JavaScript frameworks) to seamlessly interact with backend services. Express.js provides a minimal and flexible foundation for creating robust APIs, handling HTTP requests, managing routes, and processing JSON data efficiently.

This architectural choice promotes a clear separation of concerns, allowing the frontend and backend to evolve independently while maintaining smooth interoperability. Furthermore, it supports integration with third-party services (such as Zoom for virtual meetups) and ensures that user actions like complaint submission, feedback, notifications, and event scheduling are handled reliably and in real time.

5.4. User Interface

The user interface (UI) of the Constituency Connect application is designed with clarity, accessibility, and simplicity in mind, ensuring ease of use for all user roles, including constituents and representatives. The UI provides an intuitive layout for submitting complaints, tracking their resolution status, managing constituency-related tasks, and enabling communication between stakeholders. Visual cues, actionable components, and role-specific dashboards contribute to a seamless user experience, even for users with minimal technical expertise. Emphasis on responsiveness and accessibility ensures the platform works efficiently across various devices and screen sizes.

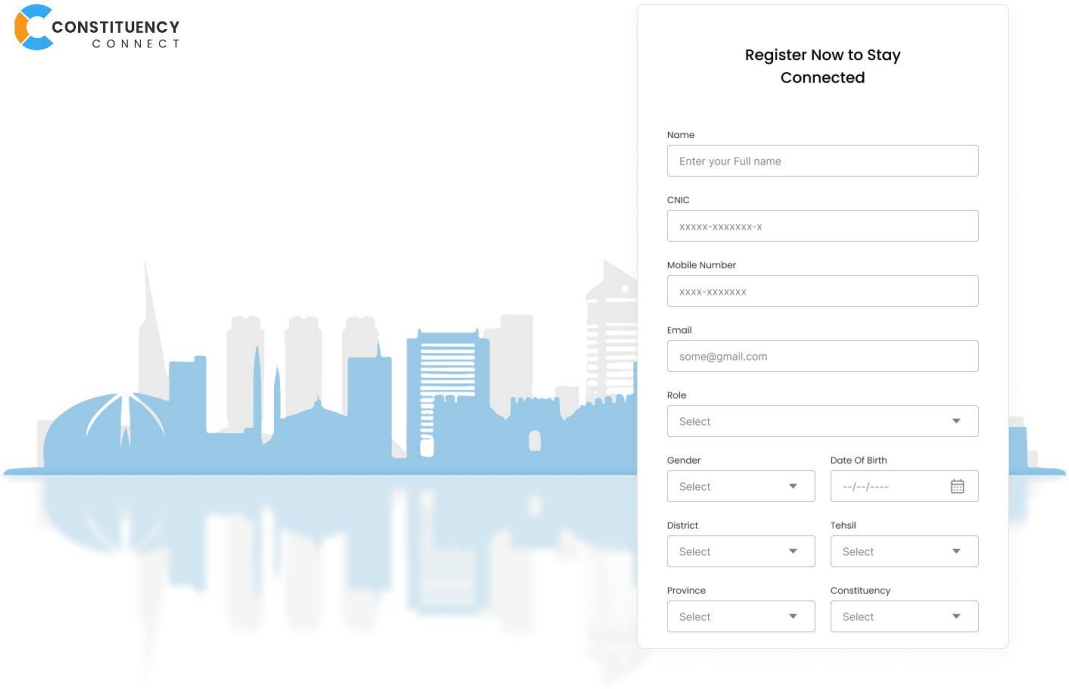

Fig 5.2: Registration Page

The Registration Form allows users to create an account by providing personal details. Users must enter their Full Name, CNIC, Mobile Number, and Email Address. They also select their Role, Gender, Date of Birth, District, Tehsil, Province, and Constituency from dropdown menus. This form collects all necessary information to register a new user.

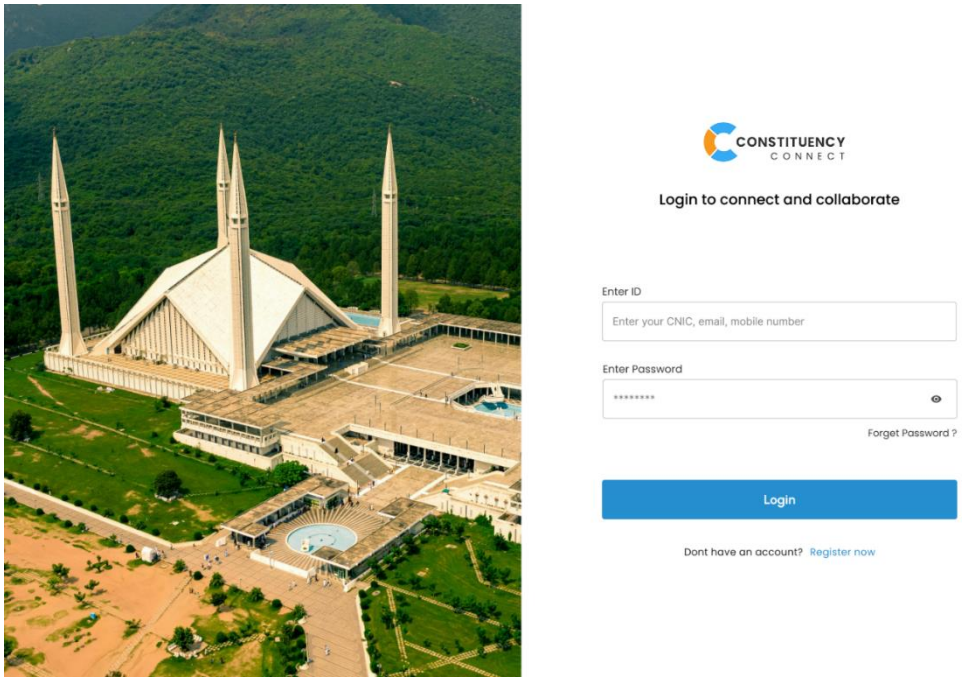

Fig 5.3: Login Page

The Login Page enables registered users to log in to the system. Users can enter their Email as their login ID and provide their Password. A "Forgot Password?" link is available for users who need assistance recovering their credentials. New users can click the “Register Now" button to create an account. This interface ensures secure access to the platform.

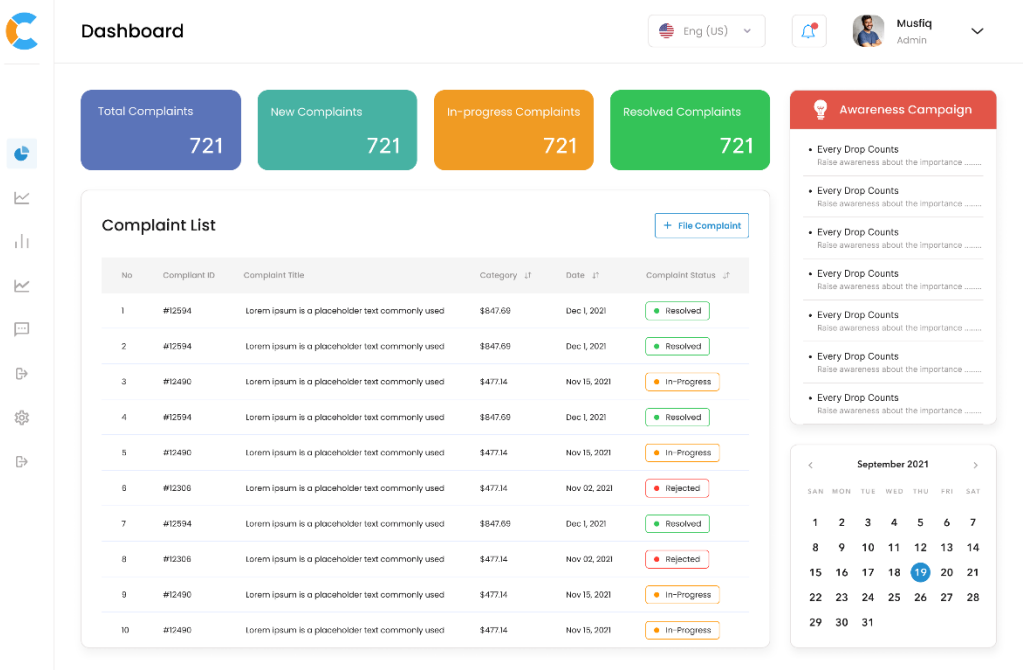

Fig 5.4: Constituent Home screen

The Constituent Dashboard provides an overview of complaint-related metrics and recent activities. It displays key statistics such as Total Complaints, New Complaints, In-progress Complaints, and Resolved Complaints in a clear, tabular format. The dashboard also includes a Complaint List section, which lists complaints with details like Complaint ID, Title, Category, Date, and Status.

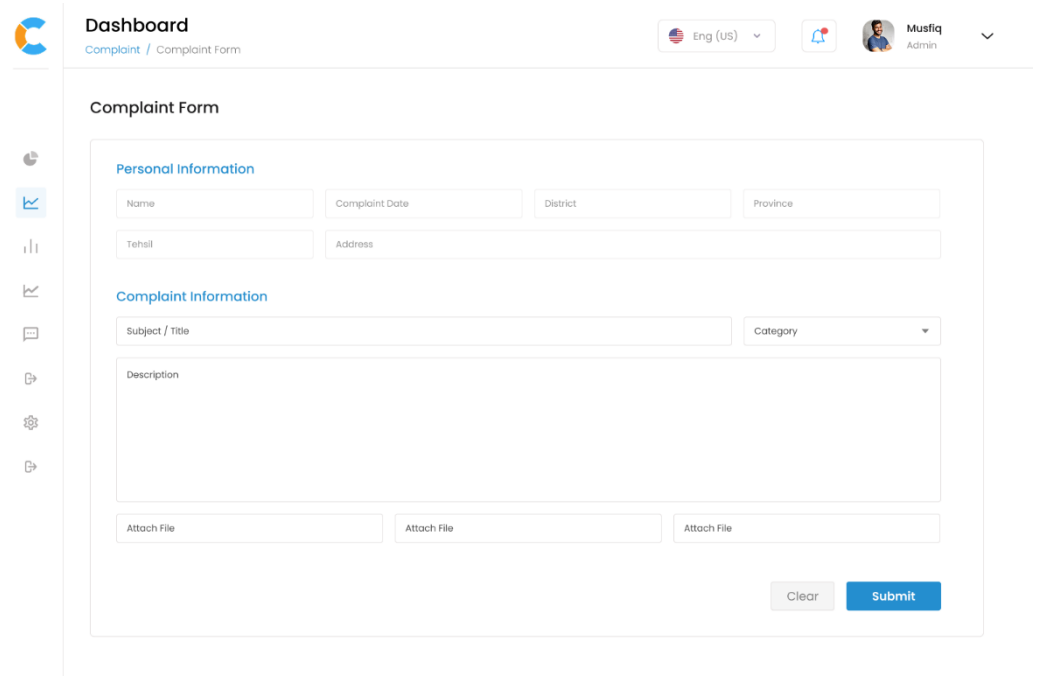

Fig 5.5: Complaint Form

The Complaint Form allows constituents to submit new complaints. Users must provide their Personal Information, including Name, District, Province, Tehsil, and Address. They also fill in the Complaint Information, such as the Subject/Title, Category, and Description. Users can attach supporting documents (up to three files) to their complaint. A Clear button resets the form, while the Submit button sends the complaint for processing.

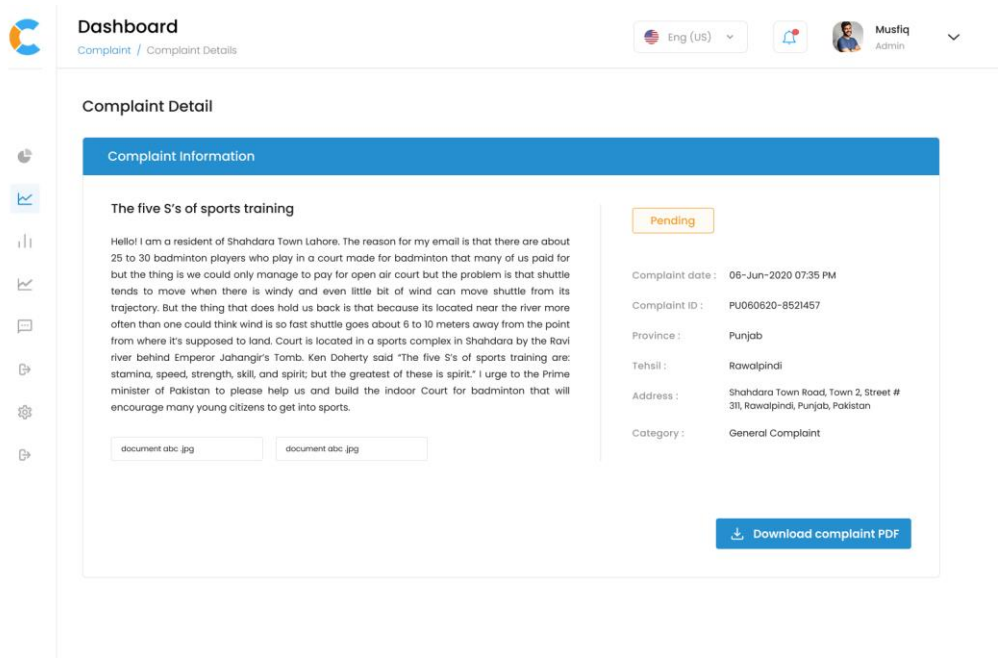

Fig 5.6: Complaint Detail

The Complaint Details View provides an in-depth look at a specific complaint. It includes information such as the Complainant's Name, Complaint ID, Date, Province, Tehsil, and Address. Additional details like the complaint Category (e.g., General Complaint) and a descriptive narrative are also displayed. Attached documents, such as images (e.g., document abc.jpg), can be viewed for further context. This interface ensures that constituents have all the necessary information about their complaints.

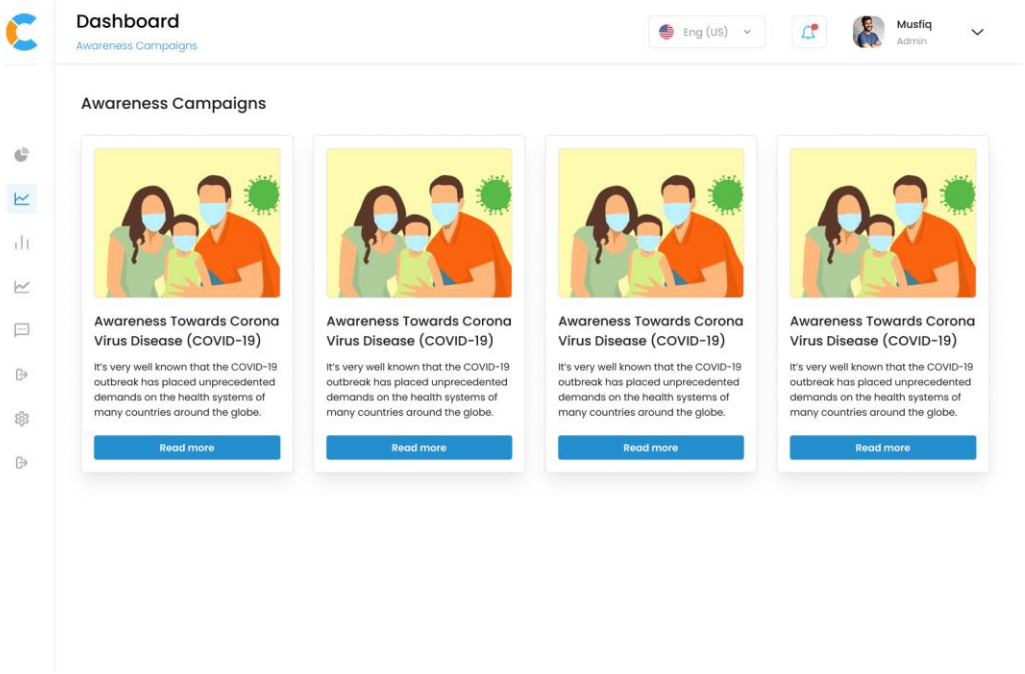

Fig 5.7: Awareness Campaign

The Awareness Campaign showcases ongoing campaigns aimed at educating users on important topics. Each campaign is represented by a title, description, and optional visuals. This section allows constituents to stay informed about current initiatives and promotes engagement with awareness programs.

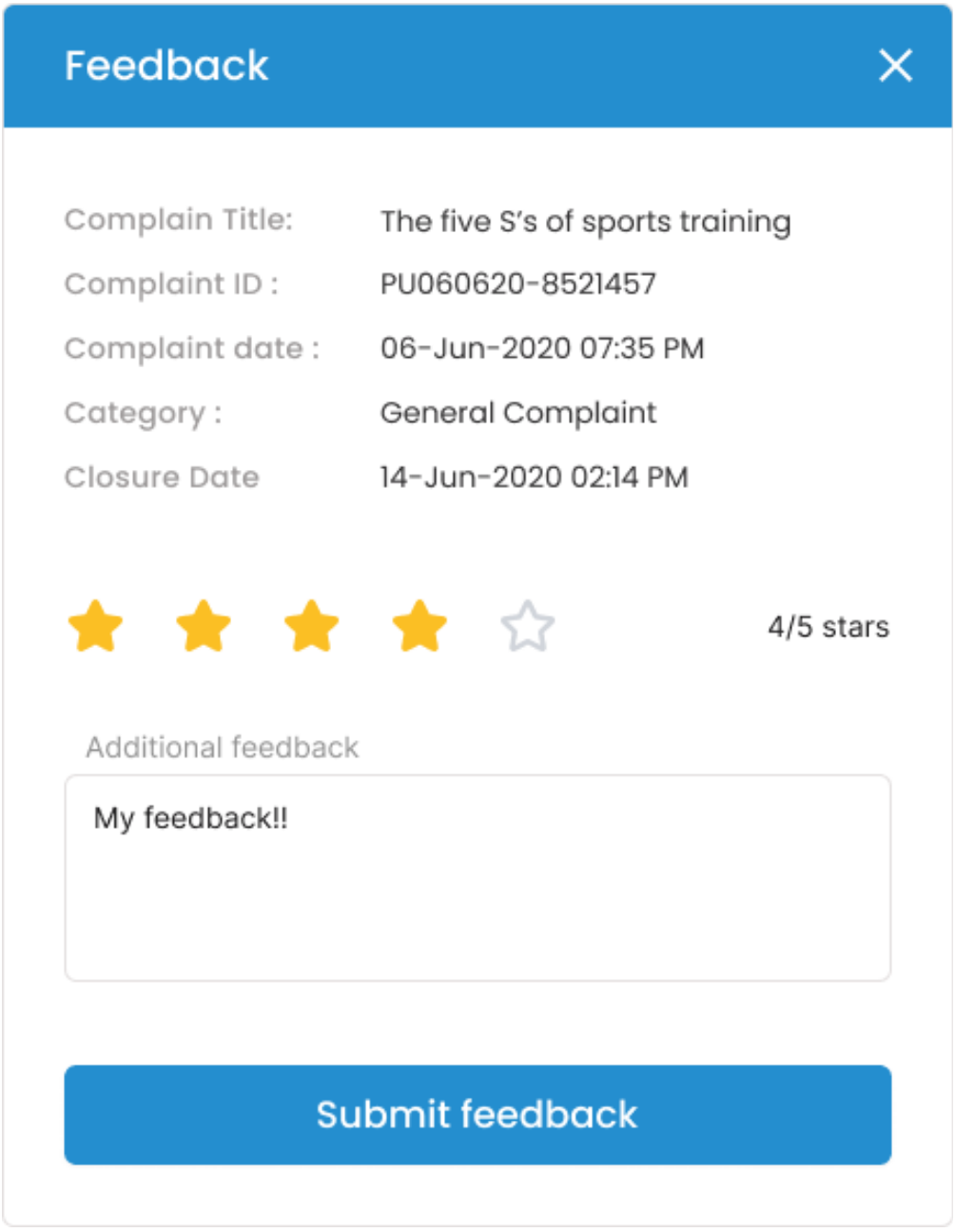

Fig 5.8: Feedback Form

The Feedback Submission Form allows constituents to provide feedback on resolved complaints.

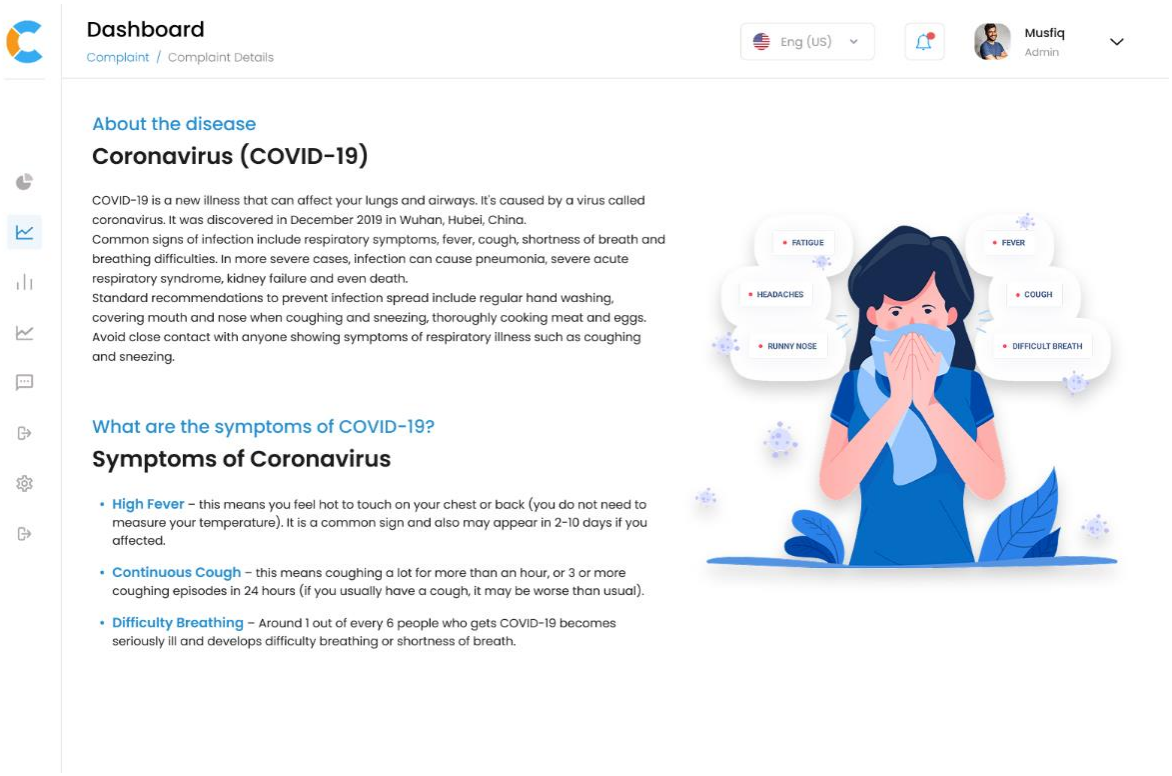

Fig 5.9: Awareness Complaint Detail

The Awareness Campaign Details section provides detailed information about specific campaigns. Each campaign includes a brief description highlighting its importance and objectives. A Read More button allows users to access additional details.

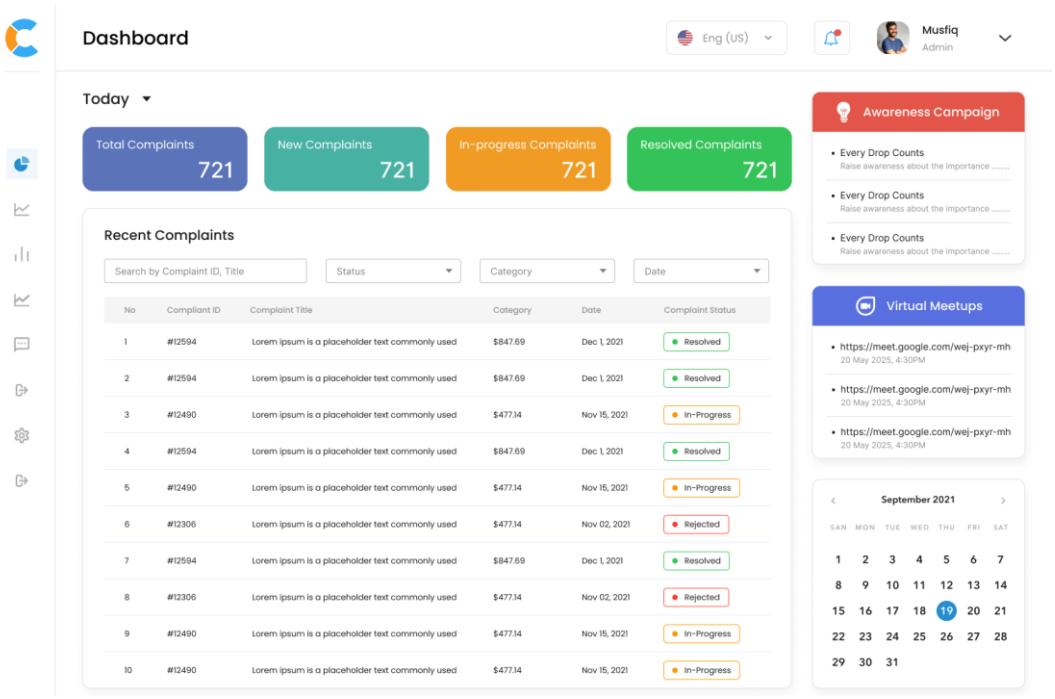

Fig 5.10: Representative Home screen

The Representative Dashboard provides an overview of complaint-related metrics and recent activities. It displays key statistics in a clear, tabular format. The dashboard also includes a Recent Complaints section, which lists complaints with details. This interface ensures that Representatives can quickly assess their workload and prioritize tasks.

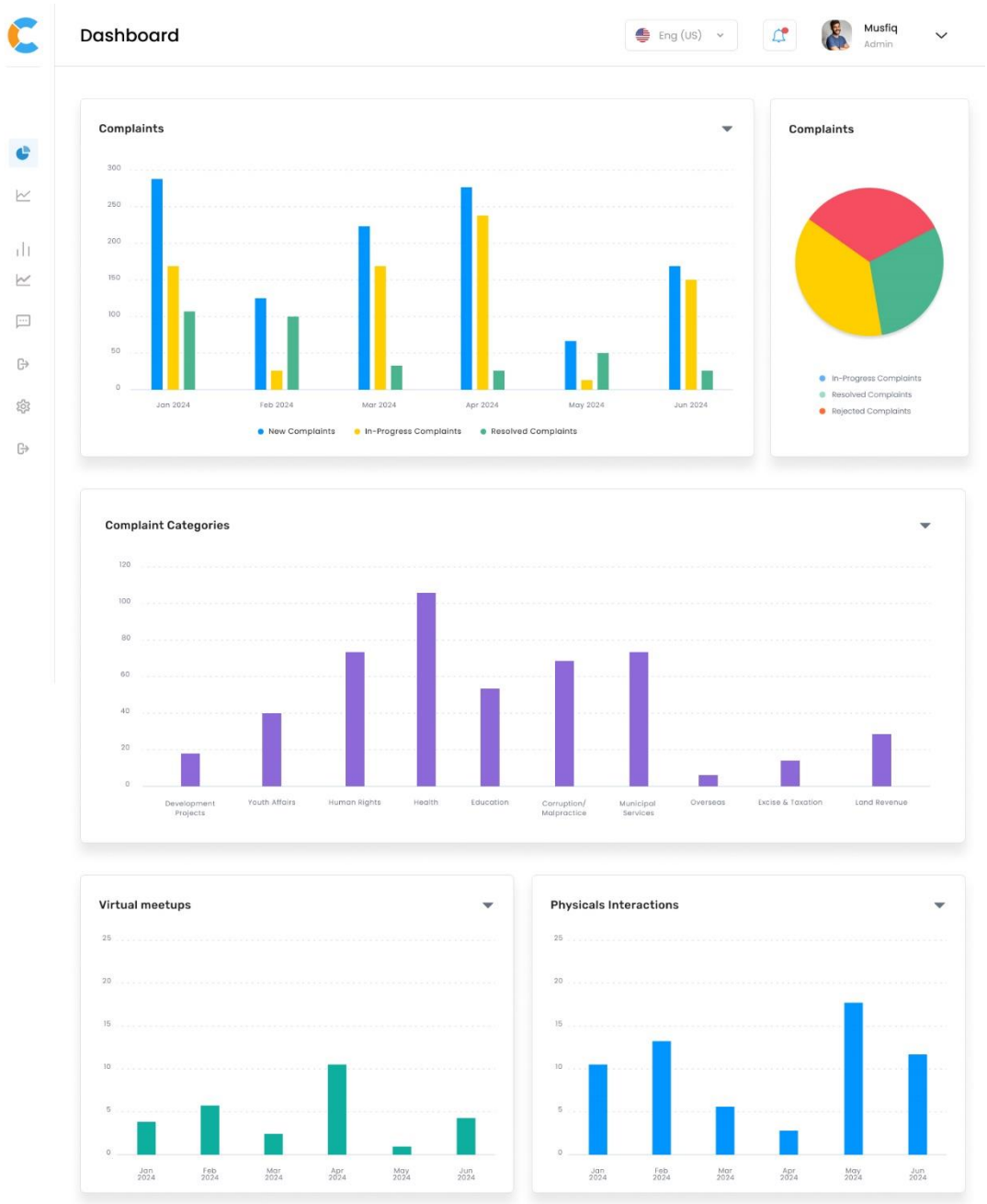

Fig 5.11: Statistics

The Statistics Overview section displays visualizations of complaint-related data. Bar charts and pie charts show metrics such as the number of New Complaints, Pending Complaints, Resolved Complaints, and Rejected Complaints over time.

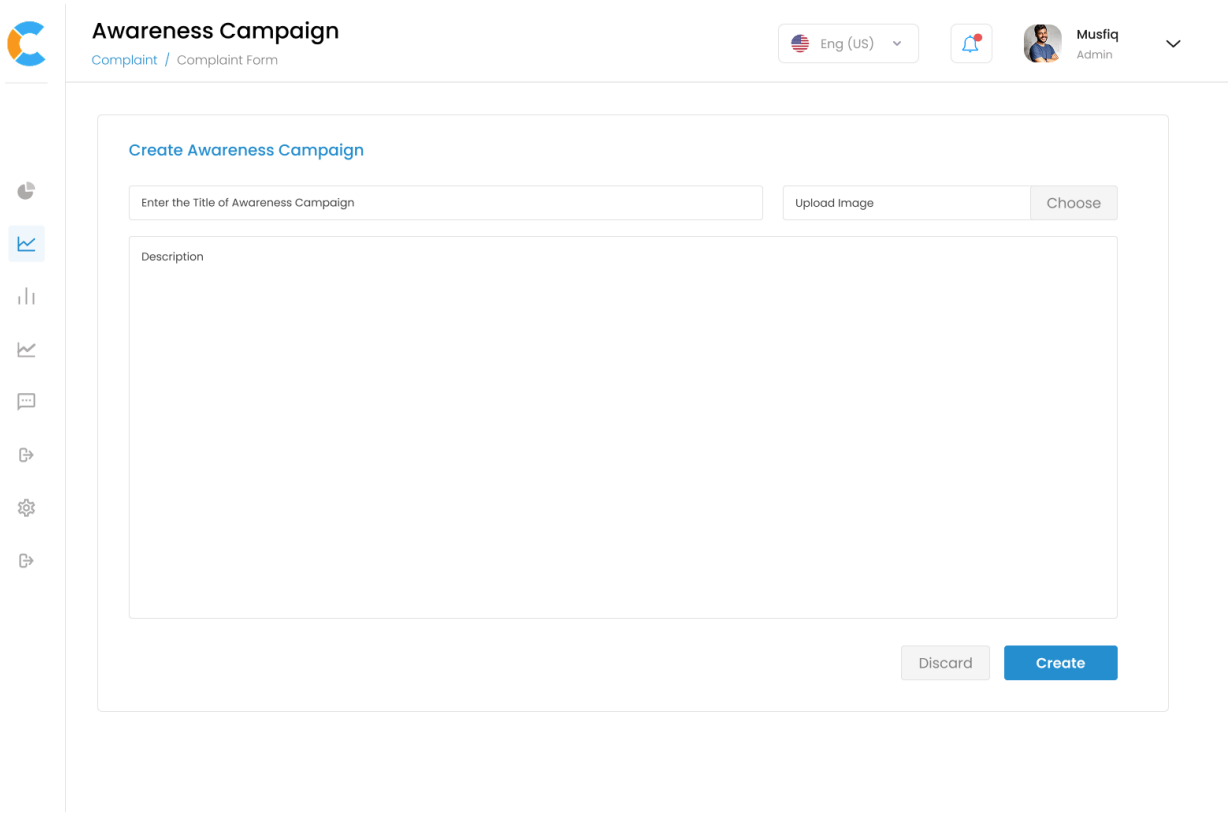

Fig 5.12: Awareness Campaign Form

The Awareness Campaign Form allows Representatives to design and publish new awareness campaigns. The form includes fields for entering the Title of the Campaign, uploading an Image, and selecting a Description from predefined templates or custom input. This interface ensures that Representatives can create impactful campaigns that align with organizational goals and address constituent needs effectively.

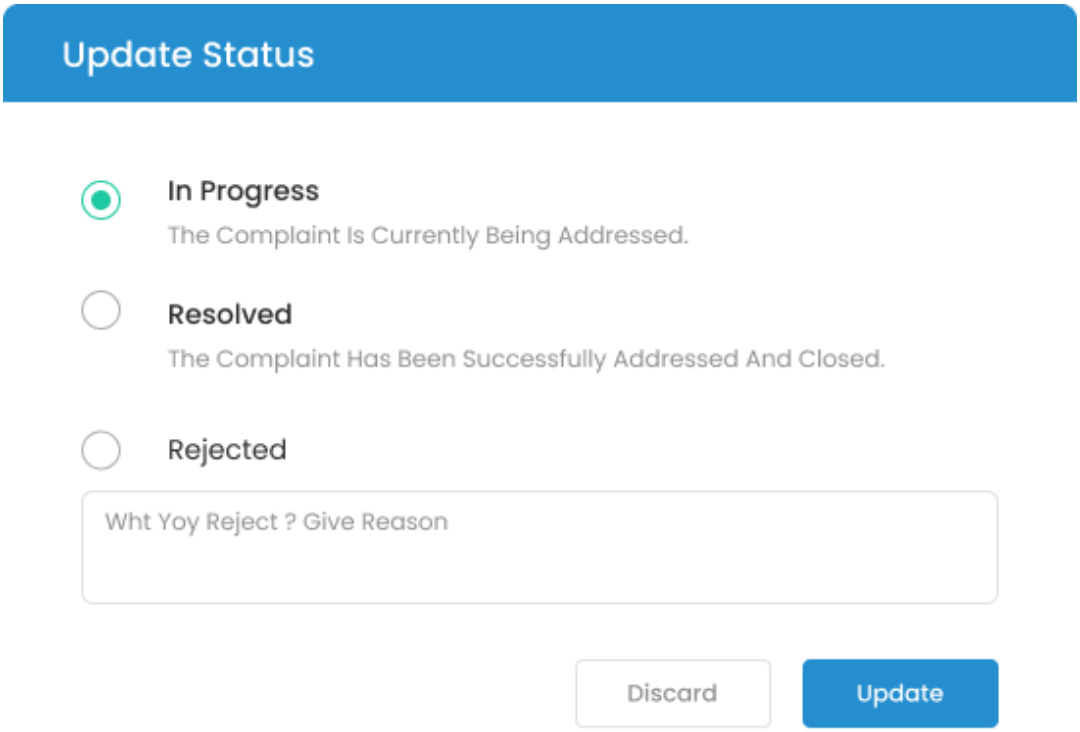

Fig 5.13: Update Complaint Screen

The Update Complaint Status interface allows Representatives to modify the status of a complaint. Options include marking it as In Progress, Resolved, or Rejected. If rejecting a complaint, a reason must be provided in the designated field. This feature ensures transparency and accountability in the complaint resolution process, enabling Representatives to communicate outcomes clearly to constituents.

Chapter 6: Testing and Evaluation

This chapter explores the thorough testing and evaluation procedures undertaken for the Constituency Connect system. From verification and functionality testing to deployment and maintenance, the chapter details the meticulous steps implemented to guarantee the reliability, usability, and efficacy of the platform. By employing a blend of testing methodologies and evaluation techniques, the chapter showcases the methodical strategy employed to authenticate and enhance the Constituency Connect system.

6.1. Verification

The Constituency Connect system ensures thorough module completion through rigorous verification, meticulous unit testing, and strict adherence to specified requirements. By leveraging documentation from earlier development stages, including requirements review, system design validation, and code evaluation, the platform maintains a high level of integrity, accuracy, and consistency throughout the development lifecycle.

6.1.1. Functionality Testing:

All functionalities within the Constituency Connect system, such as database connections and the submission, modification, retrieval, and deletion of complaints and feedback, are subjected to thorough testing. Developers conduct this testing, focusing on ensuring each feature meets its specific functionality requirements.

- **Security Testing:** Authentication, authorization, input validation, session management, and error handling are rigorously tested to strengthen the platform against unauthorized access, data breaches, and security vulnerabilities. Clerk-based authentication workflows, data encryption practices, and proper access controls are verified to ensure complete protection of user information.
- **Database Testing:** The precision, consistency, and reliability of data stored in MongoDB are meticulously evaluated. In addition, system performance under various load conditions, compliance with data protection regulations, and the effectiveness of backup and recovery mechanisms are thoroughly scrutinized to ensure seamless operation and data integrity.

6.1.2. Static Testing

Static testing within the context of the Constituency Connect system involves comprehensive review processes without executing the program. It encompasses the following key aspects:

- **Code Review:** Peer reviews are conducted to identify potential code defects, security vulnerabilities, and deviations from established coding standards. Static code analysis tools like ESLint and SonarQube are employed to automate reviews, detect code smells, potential bugs, and security risks, particularly in modules handling complaint management, user authentication, and notifications.
- **Documentation Review:** Detailed examination of software documentation, including requirements specifications, design artifacts, API documentation, and user guides, ensures completeness, clarity, and consistency with the implemented system. Any changes during development are accurately reflected and validated through documentation updates.

- **Standards and Conventions Compliance:** Verification ensures adherence to the project's coding standards, naming conventions, and architectural best practices set for the Constituency Connect system. Compliance with relevant industry standards, security policies, and data protection regulations is also rigorously maintained.

6.2. Validation

Developers rigorously test the application's validations to ensure accuracy in the Constituency Connect system. They verify that the system adheres to the specified requirements, compiles successfully, and effectively performs its designated functions, such as complaint submission, routing, response management, and notifications. Additionally, the application is evaluated to ensure it meets criteria tailored to efficient constituent-representative interactions, aligning with the system's intended purpose and objectives.

Table 6.1: Test Case for Registration

Test Case ID	**TC_SU_01**
Test Case Name	User Registration
Description	Verify that a new Constituent or Representative can successfully register using valid information.
Prerequisite	The user must have access to the registration page and a valid email address.
Steps	1. Navigate to the registration page. 2. Enter a valid full name, email, password, and role. 3. Submit the registration form.
Expected Result	The user account is created successfully, and a confirmation message is displayed.
Result	User is registered and redirected to the login page.
Pass/Fail	Pass

Table 6.2: Test Case for Login

Test Case ID	**TC_SU_02**
Test Case Name	User Login
Description	Verify that a registered user can log in using the correct credentials.
Prerequisite	The user must already be registered in the system.
Steps	1. Navigate to the login page. 2. Enter a valid email and password. 3. Click the login button.
Expected Result	The user is logged into the system and redirected to the dashboard.
Result	User successfully logs in.
Pass/Fail	Pass

Table 6.3: Test Case for Submitting Complaint

Test Case ID	**TC_SU_03**
Test Case Name	Constituent Submitting New Complaint
Description	Verifies that a constituent can submit a new complaint with valid information.
Prerequisite	The user must be logged in as the Constituent.
Steps	1. Navigate to the "File Complaint" section 2. Enter complaint details 3. Attach optional supporting files 4. Click "Submit"
Expected Result	The complaint is successfully submitted and visible in the complaint history.
Result	The user successfully submits the complaint.
Pass/Fail	Pass

Table 6.4: Test Case for View Assigned Complaints

Test Case ID	**TC_SU_04**
Test Case Name	Representative View Assigned Complaints
Description	Verifies that the representative can view all assigned complaints.
Prerequisite	The user must be logged in as the Representative.
Steps	1. View Dashboard Page 2. Navigate to the "Manage Complaints" section 3. View the list of complaints
Expected Result	The list of complaints is displayed correctly.
Result	The representative successfully views the assigned complaint.
Pass/Fail	Pass

Table 6.5: Test Case for Updating Complaint Status

Test Case ID	**TC_SU_05**
Test Case Name	Representative Updating Complaint Status
Description	Verifies whether a representative can update the complaint status.
Prerequisite	A complaint should be assigned to the representative.
Steps	1. Navigate to the Complaints section 2. Open a complaint 3. Update status dropdown 4. Save changes
Expected Result	The complaint status is updated successfully.
Result	The representative successfully updates the assigned complaint status.
Pass/Fail	Pass

Table 6.6: Test Case for Constituent Viewing Complaint Response

Test Case ID	**TC_SU_06**
Test Case Name	Constituent Viewing Complaint Response
Description	Verifies that a constituent can successfully view the response given by the representative or department to their lodged complaint.
Prerequisite	The Constituent must be logged in and must have submitted at least one complaint that has received a response.
Steps	1. Navigate to "My Complaints". 2. Locate a complaint with a status indicating "Responded". 3. Click on "View Response". 4. Read the displayed response.
Expected Result	The system should display the full response submitted by the representative.
Result	The constituent successfully views the complaint response.
Pass/Fail	Pass

Table 6.7: Test Case for Logout

Test Case ID	**TC_SU_07**
Test Case Name	Logout Functionality
Description	Verifies that users can log out of the system properly.
Prerequisite	The user must be logged in.
Steps	1. Navigate to the Dashboard screen 2. Locate the Menu in the header and click it 3. Click the "Logout" item
Expected Result	The User is logged out of the system.
Result	The User successfully logs out of the system and is redirected to the Login page.
Pass/Fail	Pass

Table 6.8: Test Case for Notifications

Test Case ID	**TC_SU_08**
Test Case Name	Notification System
Description	Verifies that the system sends notifications properly.
Prerequisite	The User is authenticated.
Steps	1. The representative updates the complaint status 2. The system triggers a notification 3. The user checks the notification panel.
Expected Result	The user receives an appropriate notification.
Result	The User successfully receives the Notification.
Pass/Fail	Pass

Table 6.9: Test Case for Viewing Complaint History

Test Case ID	**TC_SU_09**
Test Case Name	Constituent Viewing Complaint History
Description	Verify that a constituent can successfully view the history of submitted complaints.
Prerequisite	The constituent must be logged in and must have submitted at least one complaint.
Steps	1. Navigate to Dashboard. 2. Locate and Select Complaints in the Sidebar. 3. Click on the "View Complaints" button/link. 4. Review the Complaint History.
Expected Result	The system should list all past complaints with appropriate details.
Result	The complaint history is displayed correctly and chronologically.
Pass/Fail	Pass

Table 6.10: Test Case for Viewing Awareness Campaign

Test Case ID	**TC_SU_10**
Test Case Name	View Awareness Campaigns
Description	Ensures that constituents can view active awareness campaigns.
Prerequisite	Awareness campaigns must be created and published.
Steps	1. Navigate to the "Awareness Campaigns" section. 2. Browse the list of upcoming campaigns. 3. Click on any campaign to view details.
Expected Result	The system should display a list of campaigns with their titles and descriptions.
Result	The list and details are displayed correctly.
Pass/Fail	Pass

Table 6.11: Test Case for Creating Awareness Campaign

Test Case ID	**TC_SU_10**
Test Case Name	Representative Creating Awareness Campaign
Description	Verify that a representative can create a new campaign.
Prerequisite	The Representative must be logged in.
Steps	1. Navigate to the "Create Campaign" section. 2. Fill in campaign title, description, date, and time. 3. Submit the form. 4. Confirm the campaign appears in the list.
Expected Result	The campaign should be created.
Result	Campaign created and listed successfully.
Pass/Fail	Pass

Table 6.12: Test Case for Viewing Event Calendar

Test Case ID	**TC_SU_12**
Test Case Name	Constituent Viewing Event Calendar
Description	Verify that a constituent can view the event calendar showing all upcoming events.
Prerequisite	The constituent must be logged in. At least one event must be scheduled.
Steps	1. Navigate to the "Event Calendar" section. 2. View upcoming events displayed in calendar format. 3. Click on any event to see its details.
Expected Result	The calendar shows upcoming events with clickable event details.
Result	Event calendar and event details are displayed correctly.
Pass/Fail	Pass

Table 6.13: Test Case for Scheduling Virtual Meetup

Test Case ID	**TC_SU_13**
Test Case Name	Representative Scheduling a Virtual Meetup
Description	Verify that a representative can successfully schedule a new virtual meetup.
Prerequisite	A representative must be logged in.
Steps	1. Navigate to the "Schedule Virtual Meetup" section. 2. Fill in title, date, time, and meeting link (e.g., Zoom). 3. Submit the form. 4. Verify that the virtual meetup appears in the calendar.
Expected Result	A virtual meetup is scheduled and appears in the event listings/calendar.
Result	Meetup scheduled successfully and is visible to users.
Pass/Fail	Pass

Table 6.14: Test Case for Joining a Virtual Meetup

Test Case ID	**TC_SU_14**
Test Case Name	Constituent Joining a Scheduled Virtual Meetup
Description	Verify that a Constituent can successfully join a scheduled virtual meetup.
Prerequisite	The Constituent must be logged in. A virtual meetup must be scheduled and upcoming.
Steps	1. Locate and visit the Event Calendar. 2. Navigate to "Upcoming Virtual Meetups". 3. Click "Join" on an upcoming meetup. 4. Redirect to the provided meeting link (e.g., Zoom).
Expected Result	A Constituent is successfully redirected to the virtual meetup.
Result	The Constituent joins the meeting without issues.
Pass/Fail	Pass

Table 6.15: Test Case for Constituent Feedback

Test Case ID	**TC_SU_15**
Test Case Name	Constituent Feedback on Complaint Resolution
Description	Verify that a constituent can successfully submit feedback after a complaint has been resolved.
Prerequisite	The constituent must be logged in. A complaint must have been marked as resolved.
Steps	1. Visit the Dashboard Home screen. 2. Navigate to "Resolved Complaints". 3. Click "Provide Feedback" on a resolved complaint. 4. Fill in feedback comments and submit.
Expected Result	Feedback is submitted successfully and saved in the system
Result	Feedback submitted and confirmation shown.
Pass/Fail	Pass

Table 6.16: Test Case for Invalid Registration

Test Case ID	**TC_ERR_01**
Test Case Name	Constituent Feedback on Complaint Resolution
Description	Ensure the system blocks registration when the user provides an invalid email and/or a weak password.
Prerequisite	The registration page is accessible.
Steps	1. Open the registration page. 2. Enter an invalid email (`user@`) 3. Enter a weak password (`123`) 4. Click “Sign Up”.
Expected Result	Registration fails with clear validation messages for both invalid email and weak password.
Result	System blocks user registration and provides error messages
Pass/Fail	Pass

Table 6.17: Test Case for Invalid Login

Test Case ID	**TC_ERR_02**
Test Case Name	Login with Incorrect Credentials
Description	Ensure the system denies login when an incorrect email or password is provided.
Prerequisite	The login page is accessible.
Steps	1. Open the login page. 2. Enter an unregistered email or the wrong password. 3. Click “Login”.
Expected Result	User is not logged in, and a message like “Invalid email or password” appears.
Result	The system blocks Homepage access and displays an error message.
Pass/Fail	Pass

Table 6.18: Test Case for Invalid Complaint Submission

Test Case ID	**TC_ERR_03**
Test Case Name	Complaint Submission with Invalid Data
Description	Ensure users cannot submit a complaint with missing or invalid details.
Prerequisite	The constituent is logged in.
Steps	1. Navigate to the Complaint Form. 2. Leave the subject or description field blank. 3. Click “Submit”.
Expected Result	The system prevents Complaint submission and displays error messages highlighting required fields.
Result	The System blocks Complaint Submission.
Pass/Fail	Pass

Table 6.19: Test Case for Virtual Meetup Join Failure

Test Case ID	**TC_ERR_04**
Test Case Name	Virtual Meetup Join Failure Due to Expired Link.
Description	Ensure users cannot join virtual meetups via expired or invalid links.
Prerequisite	The constituent has access to an expired/invalid virtual meetup link.
Steps	1. Go to the Virtual Meetups section. 2. Click on a past event or an invalid link. 3. Attempt to join.
Expected Result	The system shows a message like “Invalid Meeting link”.
Result	The User is unable to join the meetup.
Pass/Fail	Pass

Table 6.20: Test Case for Invalid Awareness Campaign

Test Case ID	**TC_ERR_05**
Test Case Name	Awareness Campaign Creation with Missing Fields
Description	Ensure representatives cannot create an awareness campaign without all required fields.
Prerequisite	The representative is logged in.
Steps	1. Visit "Create Awareness Campaign". 2. Leave out the campaign title or date. 3. Click “Submit”.
Expected Result	The campaign is not created, and the system shows error messages for missing fields.
Result	Campaign is not created; system displays validation error messages.
Pass/Fail	Pass

6.3. Usability Testing

In the usability testing phase for the Constituency Connect system, specific criteria and objectives were established to align with user expectations and application requirements. Representative users, including constituents and representatives, were enlisted to partake in testing sessions, during which they interacted with the system to assess its intuitiveness, navigation flow, and overall user experience. Feedback gathered from these interactions was carefully analyzed to identify areas for improvement in the design and interface of the application, ensuring its effectiveness in facilitating seamless communication and issue resolution between constituents and their elected representatives.

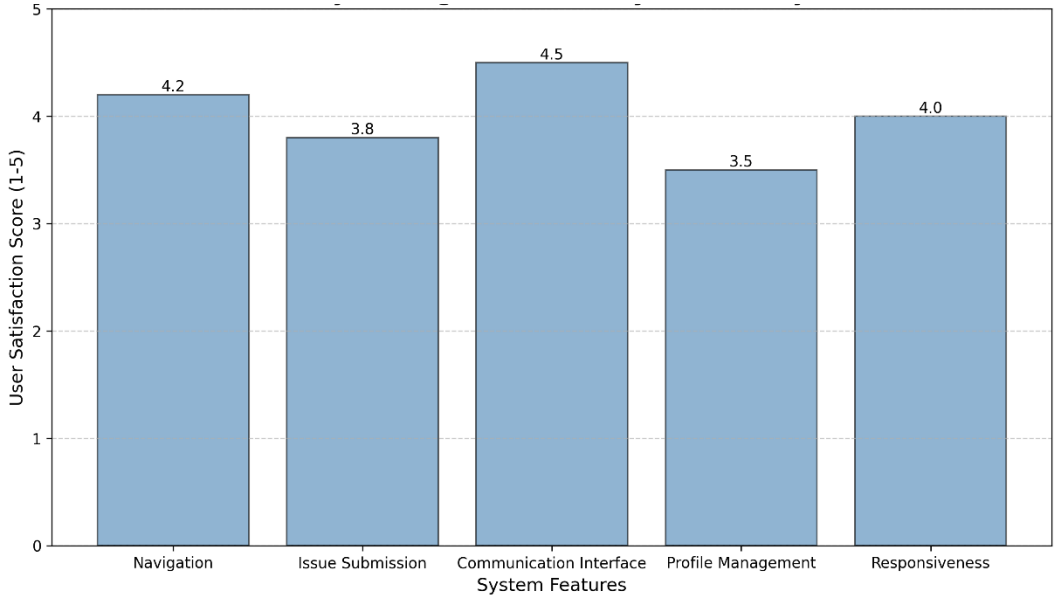

Fig 6.2: Usability Testing of Constituency Connect

6.4. Module / Unit Testing

Module and unit testing were performed to assess the functionality and behavior of individual components or modules of the Constituency Connect system in isolation. Test cases were designed and executed to verify the accuracy, performance, and effectiveness of each module independently, such as user authentication, complaint submission, complaint management, and notification delivery. After identifying and resolving any defects uncovered during unit testing, these thoroughly tested modules were integrated into larger system components, ensuring smooth interaction between different features and maintaining overall system stability.

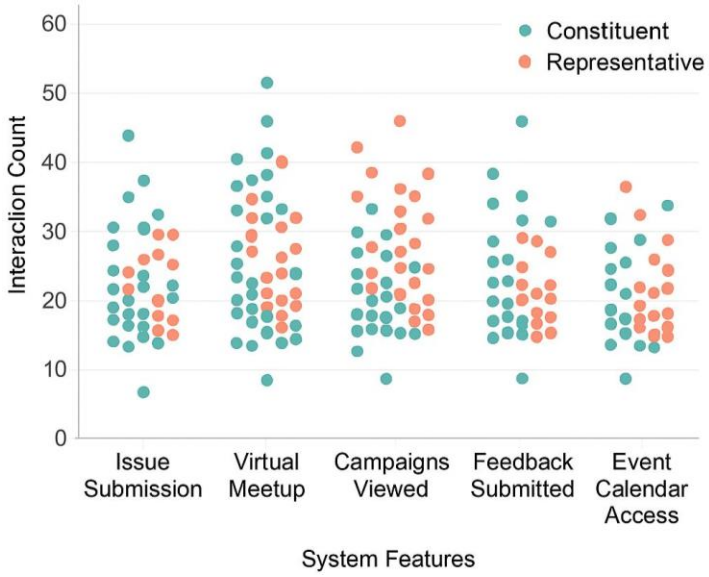

Fig 6.3: Unit Testing of Constituency Connect

6.5. Integration Testing

Integration testing for the Constituency Connect system focused on identifying integration points between various modules and components, such as user authentication, complaint submission, complaint routing, and notification handling. Test cases were designed to validate the interaction and data flow between these integrated components, ensuring smooth communication, data consistency, and compatibility across the platform. Any issues or discrepancies discovered during testing were promptly addressed to guarantee the seamless and efficient operation of the entire Constituency Connect system.

6.6. System Testing

System testing for the Constituency Connect system involved a comprehensive evaluation of the fully integrated application, encompassing all modules and components including complaint submission, representative interaction, feedback mechanisms, awareness campaigns, event calendar, and virtual meetups. Carefully crafted test cases were executed to ensure both functional and non-functional requirements were met. This phase assessed the system's end-to-end behavior, performance under load, usability, and data security across a variety of user roles and usage scenarios. All identified defects or inconsistencies were

thoroughly logged, reported, and resolved to ensure the system maintained high standards of quality, reliability, and user satisfaction.

6.7. Acceptance Testing

Acceptance testing for the Constituency Connect system focused on validating the platform against clearly defined acceptance criteria to ensure it aligned with the expectations and requirements of all stakeholders, including constituents and elected representatives. Test scenarios were developed based on core system objectives and stakeholder input, covering key functionalities such as user registration, complaint submission, viewing complaint responses, representative-constituent interaction, awareness campaign creation, event calendar viewing, and virtual meetup scheduling and participation. Selected stakeholders and representative users actively participated in the testing sessions to assess the system's usability, accuracy, and effectiveness. Feedback gathered during this phase was analyzed to resolve any outstanding issues, ensuring the system was fully functional and ready for final approval and deployment.

6.8. Stress Testing

Stress testing was conducted to evaluate the platform's performance under extreme and peak load conditions, such as high volumes of simultaneous complaint submissions, bulk notifications, and concurrent virtual meetup access. Test scenarios were crafted to simulate resource-intensive operations, including thousands of users interacting with the system at once, representatives managing multiple awareness campaigns, and real-time data flow between modules. The system's responsiveness, scalability, and stability were closely monitored during these simulations. Any performance bottlenecks or system slowdowns were identified, and necessary optimizations and infrastructure adjustments were applied to ensure the system remains reliable and functional even under high-stress usage.

6.9. Hardware Configuration for Testing

Hardware configuration testing for the Constituency Connect system involved validating the application's compatibility and performance across a range of hardware setups to ensure

consistent and reliable user experience. Multiple test environments were prepared using different devices (such as desktops, laptops, tablets, smartphones), operating systems (including Windows, macOS, Linux), and web browsers (like Chrome, Firefox, Safari, and Edge). Test cases focused on verifying UI responsiveness, feature accessibility, and performance metrics across all configurations. Any identified compatibility issues or performance disparities were resolved to ensure that users, both constituents and representatives, experience smooth and consistent functionality regardless of the platform or device they use.

6.10. Evaluation

Evaluation activities for the Constituency Connect system encompassed a thorough review of all testing artifacts, including test case results, defect logs, and system behavior reports. The team conducted an in-depth analysis of both functional and non-functional test outcomes to identify gaps, recurring issues, and improvement opportunities. Post-testing review sessions and retrospective meetings were held with the QA team and stakeholders to discuss lessons learned and to gather feedback on the overall testing and development process. Key findings and actionable recommendations were documented and integrated into the continuous improvement plan. These evaluation activities played a crucial role in enhancing system quality, guiding future development iterations, and optimizing both the user experience and technical performance of the Constituency Connect platform.

6.11. Deployment

Deployment activities for the Constituency Connect system encompassed a range of critical tasks, including preparing the application for deployment, scheduling deployment timelines, and executing deployment processes to production environments. Following deployment, smoke tests were conducted to validate core system functionalities such as user authentication, complaint registration, and notification delivery. Any deployment-related issues were promptly identified and resolved. Continuous monitoring throughout the deployment process ensured a smooth transition to the live environment, maintaining system stability and ensuring

uninterrupted service for all users.

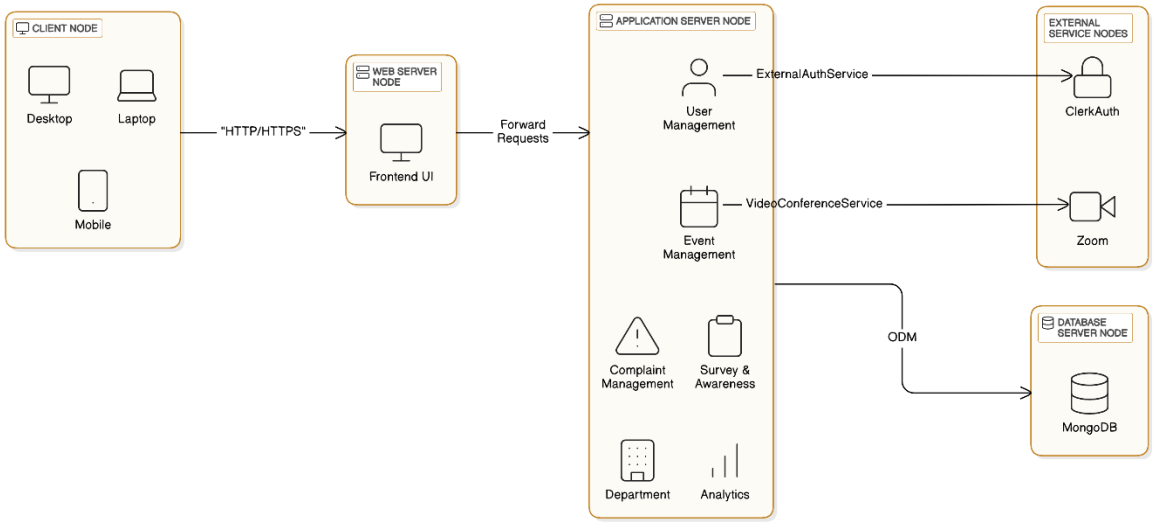

Fig 6.4: Deployment Diagram

6.12. Maintenance

Maintenance activities for the Constituency Connect system involved providing consistent post-deployment support to ensure the platform remained secure, stable, and user-friendly. These activities included resolving reported bugs, applying security patches, and introducing feature enhancements based on user feedback and evolving stakeholder requirements. After each update or code change, regression testing was performed to confirm that previously functional components continued to operate as expected without introducing new issues. All maintenance tasks were meticulously documented, including details of fixes, version updates, and testing outcomes, to support traceability, audits, and future system improvements. This continuous maintenance process was critical to sustaining the long-term performance and trustworthiness of the Constituency Connect system.

Chapter 7: Conclusion and Future Work

7.1. Conclusion

The Constituency Connect system is designed to transform citizen-representative interaction by offering a user-centric, transparent, and accessible digital platform. It empowers constituents to voice concerns, track complaint resolutions, and engage with awareness campaigns and virtual meetups, fostering a culture of accountability and responsiveness. The system enables representatives to manage public concerns, launch initiatives, and communicate effectively with their constituents, thereby strengthening democratic engagement. Constituency Connect bridges the gap between governance and the public by leveraging technology to build trust, transparency, and timely service delivery, ultimately contributing to more responsive and inclusive public service.

7.2. Future Work

To further enhance the Constituency Connect system and broaden its impact, several future developments are envisioned:

1. **Advanced Analytics and Insights**: Implementing data analytics dashboards for representatives and administrators to gain actionable insights from constituent feedback and complaint patterns, enabling data-driven policy and service decisions.
2. **Mobile Application Development**: Creating a mobile version of the system will improve accessibility, allowing constituents and representatives to engage with the platform conveniently on smartphones.
3. **AI-Powered Complaint Categorization and Routing**: Integrating AI to automatically categorize complaints and route them to the relevant department or personnel for faster resolution and reduced manual intervention.
4. **Multilingual Support**: Incorporating regional language options to cater to a diverse user base across different provinces and communities, improving inclusivity.
5. **Integration with Government Systems**: Linking the system with existing government databases and portals to streamline identity verification, track complaint progress across departments, and ensure transparency.

6. **Scalability and National Rollout**: Scaling the platform for nationwide deployment across all constituencies, allowing broader citizen participation and government responsiveness.

These enhancements aim to ensure that Constituency Connect evolves into a powerful civic-tech tool for participatory governance, citizen empowerment, and accountable leadership.

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