COTSEYE: A CROWDMAPPING SYSTEM FOR THE MONITORING REPORT OF THE CROWN–OF–THORNS STARFISH (*Acanthaster planci*) IN SARANGANI BAY

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CHAPTER I

Introduction

This chapter introduces the background of the project and the problem found by the proponents. The proceeding sections will discuss the objectives of the project, scope and limitations, significance of the project, and the definition of terms used.

1.1 Background of the Project

Coral reefs are undergoing a worldwide crisis and are being lost at an alarming rate. Among the culprits is the Crown–Of–Thorns Starfish (COTS), *Acanthaster planci*, which according to Fisk (1990), is an enormous predator starfish that preys upon tough, stony coral polyps. Such had caused population outbreaks for a long time that led to coral reef losses in the Indo–Pacific region. This information was supported by Endean (1982) in an article, wherein these outbreaks even reached the dominant coral reef system in the world, the Great Barrier Reef found in Australia, by the middle of the 1960s, which caused heavy damage in the area.

Dumas and Bigant (2020) stated that the frequency and intensity regarding the population outbreak of the Crown–Of–Thorns Starfish increased in the current times among coral reefs of the Indo–Pacific region due to global warming, as such species thrive well in warm waters. Herein the Philippines, UnderwaterTimes.com (2007) shared a study that revealed hardly a percent of the coral reefs in the country remain pristine. Moreover, the COTS outbreak was recorded by the World Wildlife Fund (2007) recent years ago at Apo Reef as well as Puerto Galera in Mindoro, Mabini in Batangas, Roxas in Palawan, Bolinao in Lingayen Gulf, and particularly the area of the study, Kiamba as well as Glan in Sarangani Bay.

1.2 Statement of the Problem

The Sarangani Bay Protected Seascape–Protected Area Management Office (SBPS–PAMO), which maintains and protects the coastal and marine resources along the Sarangani Province, recorded that the Crown–Of–Thorns Starfish (COTS) caused a population outbreak in Sarangani Bay earlier in 2007 and 2010. Later on, a concerned citizen notified the office last 2021 and found an ongoing COTS infestation near Taluya, a barangay of Glan in Sarangani.

Accordingly, the SBPS–PAMO Officers conducted a series of validation and mapping and later found out that the COTS caused a population outbreak throughout Sarangani Bay, the most destructive one recorded in the Philippines. Thereupon, at least 36 out of 68 barangays near the coast in Sarangani are still undergoing population outbreaks of COTS, with marine protected areas located therein heavily affected.

The population outbreak of the COTS under the waters of Sarangani Bay may cause food insecurity to the communities near the coast of Sarangani and destruction of the pristine corals left in the marine protected areas and sanctuaries. Nowadays, the SBPS–PAMO Officers manage the current situation in Sarangani Bay by holding a community collection wherein rice is offered, and gathering COTS every weekend.

The SBPS–PAMO Officers monitor the COTS outbreak in Sarangani Bay by mapping the information gathered. Yet, this is challenging, given that therein are difficulties in determining affected locations early, which hinders the outbreak declaration of the government. Also, the information is stored in a spreadsheet, which still needs a manual report that adds more work to the office (C. Lagason Jr., personal communication, October 20, 2022).

In that case, a solution is necessary as a means to resolve the situation of the SBPS–PAMO within Sarangani Bay. Hence, the proponents envisioned a web–based system that can provide features such as collecting and managing information gathered regarding the COTS

presence in the waters of Sarangani Bay by the use of several procedures that will help gather information from the crowd itself.

1.3 Technology Application Context

The crowdmapping system for the monitoring report of the Crown–Of–Thorns Starfish (COTS), *Acanthaster planci*, in Sarangani Bay, will only comprise a web–based system. Figma, Microsoft PowerPoint, and Adobe Photoshop were used for prototype design. Then, Visual Studio Code will be used as the integrated development environment for the web–based system. HTML, JavaScript, or CSS will be used as the programming languages for the front–end portion of the project development, while Python or PHP will be used for the back–end portion. Accordingly, MySQL or SQLite will be used as the relational database management system of the project. Google Maps API will be used to display the map of Sarangani Bay.

1.4.1 General Objectives of the Project

To develop a crowdmapping system that will help collect and manage information about COTS presence in the waters of Sarangani Bay.

1.4.2 Specific Objectives of the Project

The specific objectives of the project are:

1. To create a web–based system that will let the contributors report about COTS presence in Sarangani Bay coastal areas;
2. To develop a feature that will allow the SBPS–PAMO Officers to verify the information before they are posted;
3. To enable posting of announcements and other helpful information about COTS infestation and intervention programs;

4. To map out the COTS infestation based on the gathered information from contributors, SBPS–PAMO, and other concerned citizens;
5. To display the status of COTS infestation in the coastal areas of Sarangani Bay based on the metrics laid out by SBPS–PAMO;
6. To generate monitoring reports regarding the COTS infestation based on the information gathered from contributors.

1.5 Significance of the Project

The crowdmapping system is crucial to secure and maintain the monitoring report of Crown–Of–Thorns Starfish (COTS) presence in the waters of Sarangani Bay. Herein the capstone project, the proponents hope to develop a web–based system that will help lessen the difficulties in collecting and managing information about COTS presence. With this, the project may have a significant value to the following:

To the Sarangani Bay Protected Seascapes–Protected Area Management Office (SBPS–PAMO), the project will assist them to collect and manage information regarding the COTS presence in Sarangani Bay via web–based system. Moreover, such may also help them find possible solutions that might be useful with the monitoring reports generated in the system.

To the community, the project will provide them with access to information regarding the COTS presence in Sarangani Bay via web–based system. Moreover, such will let them send posts that will help the office locate the COTS.

To the future researchers, the project will come in handy and supply them with additional information in the fulfillment of their research and studies related to the COTS presence in Sarangani Bay. Accordingly, the project may also be innovated and enhanced more by them in order to achieve efficient usage.

To the policymakers, the project will guide them on their political declaration and judgment regarding the population outbreak of COTS in Sarangani Bay via the conclusions made from the monitoring reports generated in the system.

1.6 Scope and Limitations

The capstone project will be developed only for Sarangani Bay Protected Seascape–Protected Area Management Office (SBPS–PAMO). Keeping that in mind, such will highlight the development of a crowdmapping system for the monitoring report of the Crown–Of–Thorns Starfish (COTS), *Acanthaster planci*, in the waters of Sarangani Bay. The needed information and resources regarding COTS will only be provided by the SBPS–PAMO Officers.

The web–based system may be accessed by the community and the SBPS–PAMO Officers with a user name and password. Then, they can only send posts regarding a sighting of a COTS in Sarangani Bay, view mapped locations, infestation status, announcements, and interventions. Such notes that only the SBPS–PAMO Officers can manage the infestation status, announcements, activities, interventions, and verify the posts sent by the community.

By way of illustration, a use case diagram will help explain further the following details of activities stated hereinabove, as shown below within Figure 1.1, also along with such descriptions inside Tables 1.1, 1.2, and 1.3.

Figure 1.1. Administrator, SBPS–PAMO Officers, and Contributor's Use Case Diagram

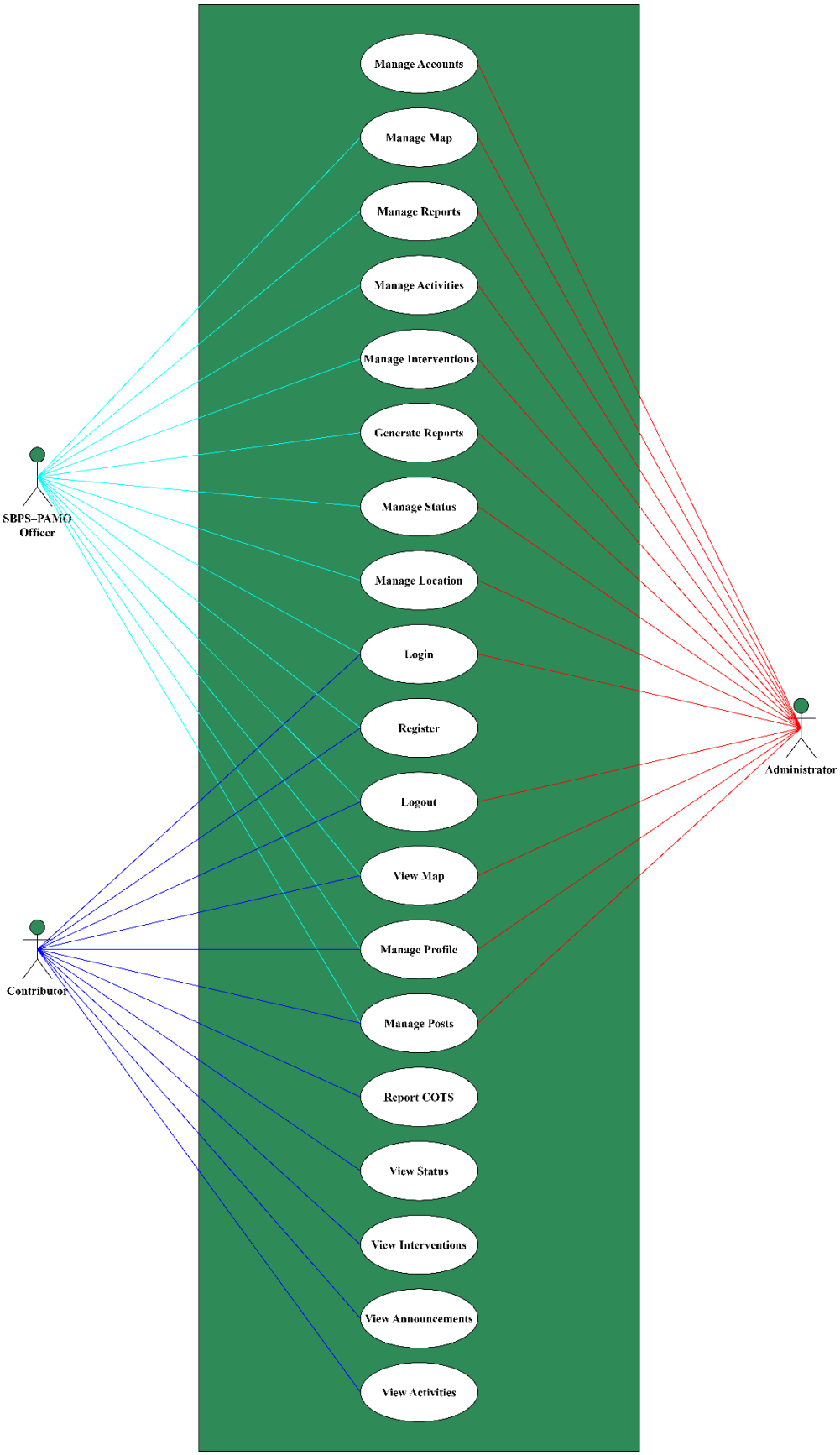


Table 1.1. Administrator's Use Cases Description

Use Case	Description
Login	The administrator can login to the web–based system by the entry of user name and password.
Manage Accounts	The administrator can manage the records that the contributor and SBPS–PAMO Officer entered during registration.
Manage Location	The administrator can manage a location that will be the basis later to sort out the activities, infestation status, and interventions.
Manage Reports	The administrator can manage the posts sent by the contributor before such will be added to the pin of equivalent location.
Manage Map	The administrator can view the entire map of Sarangani Bay and update as well as delete such whenever they want.
Manage Announcement	The administrator can add an announcement for the contributor to view regarding the upcoming COTS infestation and intervention programs.
Generate Reports	The administrator can generate a monitoring report regarding the COTS outbreak.
Manage Activities	The administrator can manage activities done in a location to combat the COTS outbreak.
Manage Interventions	The administrator can manage interventions applied in a location to combat the COTS outbreak.
Manage Status	The administrator can manage the COTS infestation status taken in a location.
Logout	The administrator can logout into the web–based system with a single click on the logout button.

Table 1.2. SBPS–PAMO Officer's Use Cases Description

Use Case	Description
Login	An SBPS–PAMO Officer can login to the web–based system by the entry of user name and password.
Register	An SBPS–PAMO Officer can register as a means to verify oneself and access the web–based system by registration.
Manage Profile	An SBPS–PAMO Officer can manage the records that they entered during registration.
Manage Location	An SBPS–PAMO Officer can manage a location that will be the basis later to sort out the activities, infestation status, and interventions.
Manage Reports	An SBPS–PAMO Officer can manage the posts sent by the contributor before such will be added to the pin of equivalent location.
Manage Map	An SBPS–PAMO Officer can view the entire coordinates of verified posts and update as well as delete such whenever they want.
Manage Announcements	An SBPS–PAMO Officer can manage announcements for the contributor to view regarding the upcoming COTS infestation and intervention programs.
Generate Reports	An SBPS–PAMO Officer can generate a monitoring report regarding the COTS outbreak.
Manage Activities	An SBPS–PAMO Officer can manage activities done in a location to combat the COTS outbreak.
Manage Interventions	An SBPS–PAMO Officer can manage interventions applied in a location to combat the COTS outbreak.
Manage Status	An SBPS–PAMO Officer can manage the COTS infestation status taken in a location.
Logout	An SBPS–PAMO Officer can logout into the web–based system with a single click on the logout button.

Table 1.3. Contributor's Use Cases Description

Use Case	Description
Login	The contributor can log in to the web–based system by the entry of user name and password.
Register	The contributor can register to verify oneself and access the web–based system by registration.
Manage Profile	The contributor can manage the records that they entered within the registration.
Report COTS	The contributor can send posts regarding a sighting of a COTS in an area of Sarangani Bay that will be sent later on to the SBPS–PAMO Officers for approval.
Manage Posts	The contributor can view a list of posts they sent along with the status, and update as well as delete such whenever they want.
View Map	The contributor can view the entire map of Sarangani Bay with pins that redirect to the verified reports sent from that location in a single click.
View Announcements	The contributor can view announcements regarding the upcoming COTS activities and intervention programs.
View Activities	The contributor can view activities done to combat the COTS outbreak.
View Interventions	The contributor can view interventions applied to combat the COTS outbreak.
View Status	The contributor can view COTS infestation status taken in a location for the contributor to view.
Logout	The contributor can logout into the web–based system with a single click on the logout button.

Altogether, the web–based system comprises a number of limitations within the features as outlined hereinabove.

1. The web–based system registration will record only the user name, first name, last name, email address, password, and phone number of the contributor and SBPS–PAMO Officers. Then, only the user name and password are needed to login here.
2. Such notes that the administrator will only login to the web–based system with the user name and password. By way of explanation, the administrator will be the superuser, a user account to be used for the web–based system administration.
3. File formats for photos are the only ones accepted to be uploaded as evidence sent by the contributor into the web–based system for sighting a Crown–Of–Thorns Starfish (COTS) in an area of Sarangani Bay.
4. The location to be entered into the web–based system will limit only to the coastal areas found near Sarangani Bay. Moreover, the map that will be used in the project is concentrated only within the particular area of the study.
5. The announcements, activities, and intervention programs that will be be entered by SBPS–PAMO into the web–based system will be situated only to the coastal areas found near Sarangani Bay that suffered from COTS infestation.
6. The reports to be created in the web–based system will limit only to the information based on the number of photos sent by the contributor per purok, barangay, and municipality, verified by the SBPS–PAMO Officers.
7. An Internet connection will be required throughout the use of the web–based system by the contributor and SBPS–PAMO Officers since real–time update is needed to achieve the core significance of the project.

1.7 Definition of Terms

Crowdmapping. It is the collection of a crowd–generated details such as text messages, and social media feeds with geographic data to provide real–time, interactive information on circumstances such as humanitarian crises, elections, or natural disasters (Quaintance, 2014).

Crowdsourcing. It is the process of depending on a body of individuals to attain needed knowledge, goods, or services (Estellés–Arolas & González–Ladrón–de–Guevara, 2012).

Crown–Of–Thorns Starfish (COTS). It is a voracious predator which feeds on stony coral polyps. The starfish gets its name from the toxic thorn–like spines covering its body, which resemble a biblical crown of thorns (Helgason, 2020).

Geolocation. It is the process of determining or estimating the geographic position of an object by means of digital information processed via the internet (ISO, 2018).

Population outbreak. It is characterized by a rapid change in the population density of a particular species over several orders of magnitude that often cause serious ecological and economic problems (Sharov, 1997).

CHAPTER II

Review of Related Literature and Technologies

This chapter summarizes the series of literature and technologies found by the proponents. The proceeding sections will discuss the background material that supports the project objectives and an assessment that contrasts the project with the current technologies.

2.1 Related Literature

2.1.1 Crown–Of–Thorns Starfish Outbreak

Stevens (2012) shared in an article that an excessive population of predators in each and every ecosystem carries threat and harm. This case also occurs under the sea. Referring to the research of Kayal et al. (2012), the Crown–Of–Thorns Starfish (COTS), *Acanthaster planci*, a naturally occurring corallivore that preys and decimates coral reefs, can cause food insecurity and other crises. Accordingly, such are noted by Pratchett et al. (2014) that predators of the COTS declined due to past habitat degradation and overfishing. As shared by Dixon (1996) in an issue, a population outbreak is specified as 30 or more adults of COTS per hectare on coral reefs. Herein Japan, studies conducted by Nakamura et al. (2014) showed that the country has been experiencing chronically high population densities of COTS for decades. COTS population along their coastal areas often have massive records before 2003. In modern times, this has been increasing again drastically. In French Polynesia, the Institut de Recherche pour le Développement (2013) stated that the archipelago has been suffering from a new population outbreak of COTS since 2004. The rate of healthy living coral reefs in ocean depths and lagoons alike found there has dropped from 50 percent to under 5 percent in 2009. In the Philippines, particularly in the area of the study, the coastal communities near Sarangani Bay, Gubalani (2022) reported that the people

there have been working together to collect COTS as an outbreak threatens coral reefs in the protected area. Teams composed of residents, local government workers, and volunteers have collected at least over 100 000 COTS in the last 3 months.

2.1.2 Marine Population Report

In an ecological issue written by Wells and Richmond (1995), the population is the number of individuals from a distinct species in an area. Biology Dictionary (2019) noted in an article that the management of a population must be nurtured as a means to attain ecological balance for the health and stability of an ecosystem that will let each and every species survive and lead a substantial and secure life. Hence, assessment reporting on the population of a species is an essential matter to do. Despite that, Booth et al. (2020) reported in a research that the task is an extreme ecological challenge for species under the sea. In the United States, the National Oceanic and Atmospheric Administration (2018) publish species stock reports, which cover information about the geographic range, population size and trends, productivity rates, and estimates of mortality. This information is collected by aerial, along with ship–based surveys, acoustic monitoring, photo identification studies, biopsy sampling for genetic studies, and tagging. In New Zealand, the Ministry for the Environment (2022) produces a series of marine environmental reports as a requirement under the Environmental Reporting Act. The information will originate from several sources, such as research institutes and the government. In the Philippines, the Biodiversity Management Bureau (2017) launched the Coastal and Marine Ecosystems Management Program to acquire efficient management of the coastal and marine ecosystems within the country against drivers of their degradation such as COTS in order to achieve and promote sustainability of ecosystem services and food security.

2.1.3 Crown–Of–Thorns Starfish Management

Over the last few years, the Khaled bin Sultan Living Oceans Foundation (2016) reported in their article that the Crown–Of–Thorns Starfish (COTS) outbreaks have grown in extent and frequency under the waters of the Indo–Pacific region. Such was stated to have forced marine resource managers and scientists to take action without delay. In Japan, various prefectures require special permission to eradicate or remove COTS under fisheries guidelines. Their Chugoku–Shikoku Regional Environmental Office (2012) shared in a manual that the approaches they currently use to combat COTS are land disposal, crushing them in situ, placing them in bags, and poison injection. In Australia, robotics researchers delve into an unexplored area of research. Clement et al. (2012) tried to apply robust texture recognition in underwater image sequences for COTS to autonomously collect and process images of reef habitats and segment out the various marine biota that will help in surveillance against population outbreaks of COTS. In the Philippines, Dalongeville (2019) shared in a research that the Department of Environment and Natural Resources technical bulletins encourage locally declared and managed marine protected areas in the country to adopt the Green Fins Crown–Of–Thorns Starfish Cleanup Guidelines so as to ensure the COTS control initiatives are conducted with ecological interest at the forefront. The author further stated that the approaches they use to control the COTS population are free–diving removals for shallow areas and scuba–diving injections of household vinegar for areas wherein free–diving is not feasible.

2.1.4 Implementation of Crowdmapping in Species Monitoring

Being in a world flourishing along with the digital age nowadays, Livescault (2022) tackled the concept of crowdsourcing, the submission of their ideas in response

to online appeals made, either through social media, smartphone applications, or committed crowdsourcing platforms. Therein are multiple varieties of crowdsourcing; an instance of such is photo sharing. Grabianowski (2006) reported such, wherein individuals publish photos on a website that allows contributors to share such with other online individuals or the entire web indeed. That being so, the photos gathered from crowdsourcing can also be mapped out, as shown by the research of Crandall et al. (2009), wherein they investigated and plotted a large collection of photos with a geotag in a map, working with a dataset of at least 35 million photos. Nonetheless, Reefbites (2020) shared in an article that these procedures have already been implemented to monitor widespread species and ecosystems in real time, which revealed trends and facilitated management. In recent times, Mahecha et al. (2021) conducted a study regarding 2 mobile applications applied with crowdsourcing via a photo sharing process that helps monitor occurrences of wild flowering plants over the European continent. One of the mobile applications was already able to identify 4 848 vascular plant species from photograph entrees alone, which helped researchers assess trends in plant distribution and mortality. The other one contains a database with multiple mapping campaigns that involve thousands of voluntary surveyors, as well as literature reviews that were gathered since the middle of last century.

2.2 Related Technologies

By way of explanation, an assessment of particular features between the proposed project and other chosen technologies in recent times is presented to help contrast further the following, as shown below in Table 2.1.

Table 2.1. Proposed Project and Chosen Technologies' Features Assessment

Features	Proposed Project	Marées NC	OREANET	PCBW
Create Report	✓	✓	✓	✓
Send Photos	✓	✗	✗	✓
Verify Posts	✓	✗	✗	✓
Map Locations	✓	✓	✓	✓
Send Announcements	✓	✗	✗	✗
Show Activities and Interventions	✓	✗	✗	✗
Display Infestation Status	✓	✗	✗	✗
Generate Reports	✓	✗	✗	✗

2.2.1 Marées NC

Dumas et al. (2020) described the Marées NC as a mobile application for reporting the Crown–Of–Thorns Starfish (COTS) presence in New Caledonia. The features of Marées NC are specified as shown below in Table 2.2.

Table 2.2. Marées NC's Features

Technology Name	Features
Marées NC	1. Allows the contributor access and observe the current weather, temperature, tide times, sunrise and sunset of New Caledonia; 2. Allows the contributor to send sighting reports of COTS to the Research Institute Development of New Caledonia; 3. Provides the contributor the ability to send a distress signal which will be sent to the contributor's relatives and emergency services; 4. Enables the contributor to access about 40 detailed sheets regarding the fish most frequently located in the lagoons found in New Caledonia; 5. Gives an interactive map that the contributor may use for navigation in the marine protected areas in New Caledonia.

2.2.2 OREANET

Asia Pacific Report (2016) described the OREANET as a web–based system urging to report Crown–Of–Thorns Starfish (COTS) observations and submit this via an online form. The features of OREANET are specified as shown below in Table 2.3.

Table 2.3. OREANET's Features

Technology Name	Features
OREANET	1. Allows the contributor to access several information regarding universal COTS outbreak management; 2. Gives the contributor the ability to send reports of COTS in New Caledonia through a sighting form; 3. Provides the contributor with several warnings and instructions about handling a COTS in real life; 4. Enables the contributor and administrator access and register a brand–new account with ID, electronic mail, and password; 5. Brings a highly detailed map based on the reports sent by the contributor toward the web–based system.

2.2.3 PCBW

Chan (2020) described the PCBW, or Philippine Coral Bleaching Watch, as a web–based system that has the goal of raising public awareness about the state of coral reefs in the country. The features of PCBW are specified as shown below in Table 2.4.

Table 2.4. PCBW's Features

Technology Name	Features
PCBW	1. Allows the contributor to upload several photos as optional evidence to be sent along with the report; 2. Gives the contributor the ability to geotag the uploaded photos to identify such coordinates in the map; 3. Provides the administrator to store each and every report within an offline database repository; 4. Allows the contributor send reports of coral reefs threats in the Philippines through a sighting form; 5. Brings a highly detailed map based on the validated reports sent by the contributor toward the web–based system.

Table 2.5. Proposed Project and Chosen Technologies' Comparison Assessment

Technology Name	Focus	Strength	Weakness
Marées NC	Such concentrates on forecasts in different areas of the coastal environment in New Caledonia.	Such contains multiple functions for the coastal areas, such as the sighting report of COTS, weather forecasts, and so on.	Such is unable to let the photos be sent while sending a report of COTS as a piece of evidence.
OREANET	Such concentrates on mapping and monitoring the COTS observations within New Caledonia.	Such contains a detailed and smooth mapping and detailed information regarding COTS.	Such is unable to let the photos be sent while sending a report, similar to the case of Marées NC.
PCBW	Such concentrates on mapping and monitoring the coral reefs threats within the Philippines.	Such collects information in great detail and letting the photos sent be on hold for further validation.	Such is lacking in display, unable to provide the contributor with various information regarding coral reefs threats.
Proposed Project	Such will concentrate on sending posts and monitoring report of COTS in the waters of Sarangani Bay.	Such is customized and tailored to fit the requirements and needs of the individuals wherein the project is allocated.	

Altogether, all of the chosen technologies keep the interface between a web–based system and a mobile application. Nevertheless, the proposed project is unique of them all due to the features such as sending photos, generating reports, showing interventions as well as activities, displaying infestation status, and verifying posts sent by the contributor.

CHAPTER III

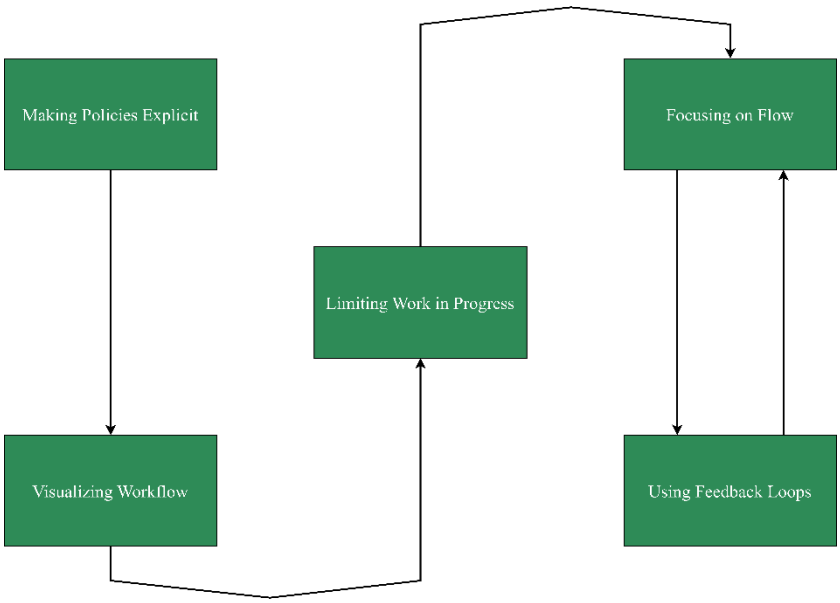
Methodology

This chapter presents the software development methodology chosen by the proponents. The proceeding sections will discuss the assigned proponents and schedules for the activities that will be executed as a means to accomplish the project.

3.1 Project Design

The overall methodology of the project will pursue the pure Kanban approach in Agile software development. By way of explanation, Adam (2022) defined in an article that Kanban is an Agile approach designed to improve the efficiency of production processes and the end quality of the products produced without overburdening the team. The use of Kanban in software development is an emerging topic. Ahmad et al. (2013) observed that such is one of the current trends in technological procedures adopted by agile teams nowadays. By way of illustration, a model will help explain the flow of development phases included in the Kanban approach further, as shown below in Figure 3.1.

Figure 3.1. Kanban Approach Model



The pure Kanban approach in Agile software development comprises 5 development phases. Accordingly, a detailed Gantt chart will help illustrate further the schedule of the proponents for the following phases, as shown below in Figure 3.2.

Figure 3.2. Project's Development Phases Gantt Chart

ID	Phases and Stages	Start	Finish	Duration	2022				2023					
					Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	Making Policies Explicit	09/20/2022	01/15/2023	117 Days										
2	Visualizing Workflow	01/13/2023	02/20/2023	38 Days										
3	Limiting Work in Progress	01/13/2023	02/20/2023	38 Days										
4	Focusing on Flow	02/20/2023	06/23/2023	161 Days										
5	Using Feedback Loops	11/14/2022	06/23/2023	221 Days										

3.2 Project Method

The proponents were determined to choose the Kanban approach in Agile software development for the overall methodology due to such versatility that lies in simplicity. The Kanban approach fits into the current workflows of the project and respects the current roles and responsibilities of the proponents. Moreover, the Kanban approach revolves around a board that helps manage the workload. Such divides the activities that are still a work in progress, the activities to do in the future, and the activities that are completed. By that means, the activities to be applied in the project will be organized along with 3 stages used in the Kanban board to each and every respective development phase, as described below.

3.2.1 Making Policies Explicit

In order to establish a successful project, the proponents decided to have clear objectives. The development phase of making policies explicit will cover the backlog stage, which comprises activities derived from the project requirements. A detailed Gantt chart will help illustrate further the schedule here, as shown below in Figure 3.3.

Figure 3.3. Making Policies Explicit Phase Gantt Chart

ID	Activities	Start	Finish	Duration	2022				2023			
					Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
	Backlog Stage	09/20/2022	01/15/2023	117 Days								
1	Problem Identification	09/20/2022	10/12/2022	22 Days								
2	Project Feasibility	10/12/2022	11/30/2022	49 Days								
3	Preliminary Interviews	10/15/2022	11/30/2023	46 Days								
4	Further Readings	12/29/2022	01/13/2023	16 Days								
5	Features Identification	12/28/2022	01/05/2023	8 Days								
6	Project Methodology	12/30/2022	01/14/2023	15 Days								
7	Prototype Design	01/05/2023	01/15/2023	10 Days								

3.2.1.1 Problem Identification

The proponents gathered problems that are considered timely and relevant in recent times. Later on, 3 of those were studied and narrowed down. Nevertheless, the proponents only chose 1 that they considered best among the rest and in need of technological intervention.

3.2.1.2 Project Feasibility

The proponents examined the feasibility of the project thoroughly. The appropriate user interface design for the problem was first discussed, followed by the analysis of current technology resources. As the final point, the proponents determined the economic costs and benefits of the project.

3.2.1.3 Preliminary Interviews

The proponents accomplished several interviews with the project stakeholder closely related to the problem. An open–ended form of the interview was applied to collect information from the project stakeholders, which was conducted through chat messages and a physical meeting at once.

3.2.1.4 Further Readings

The proponents read and reviewed numerous books, journals, scholarly articles, reports, conferences, and technologies related to each and every section of their project in order to identify the features that can be employed herein, as well as justify and find support for the project objectives.

3.2.1.5 Features Identification

The proponents searched for possible features that were appropriate to be applied in the proposed project as soon as the assessment was accomplished for various related technologies. Such notes that each and every feature were drawn in use case and activity diagram to visualize the flow of project design.

3.2.1.6 Project Methodology

The proponents investigated different software development methodologies to be followed in the project development, chose the most appropriate approach among the rest, and then analyzed such for further application in the project later on.

3.2.1.7 Prototype Design

The proponents were determined to design a prototype in order to enhance the overall understanding of the design intent. Numerous components are considered in designing the prototype so as to achieve the optimal experience for the target users of the project.

In summary, the phase of making policies explicit comprises activities derived from the team discussions, thorough readings, and project objectives and development. The activities assigned per proponent in this phase are indicated below in Table 3.2.

Table 3.2. Making Policies Explicit Activities

Activities	Fulfilled by	Fulfilled to	Deliverables
Problem Identification	Alenne Jasper Cañete, Bai Nhor Dodog, Fritz Evar Quije		Capstone Project Topic
Project Feasibility	Alenne Jasper Cañete, Bai Nhor Dodog, Fritz Evar Quije	Capstone Project Topic	Documentation
Creation of a Permission Letter for the Interview	Alenne Jasper Cañete, Bai Nhor Dodog	SBPS–PAMO	Request Letter
Inquiry for an Approval of the Letter to the Capstone Adviser	Fritz Evar Quije	Dr. Laiza Limpin	Approved Letter

Activities	Fulfilled by	Fulfilled to	Deliverables
Submission of the Approved Letter to the Deputy Superintendent and Chairperson of SBPS–PAMO	Alenne Jasper Cañete, Bai Nhor Dodog, Fritz Evar Quije	Sir Cirilo Lagnason Jr. Atty. Felix Alicer	Approved Letter
Interview with the Deputy Superintendent and Chairperson of SBPS–PAMO	Alenne Jasper Cañete, Bai Nhor Dodog, Fritz Evar Quije	Sir Cirilo Lagnason Jr. Atty. Felix Alicer	Interview Report
Further Readings	Alenne Jasper Cañete		Documentation
Research for a Methodology	Alenne Jasper Cañete		Documentation
Features Identification	Alenne Jasper Cañete, Bai Nhor Dodog, Fritz Evar Quije		Project Features
Use Case Diagrams	Alenne Jasper Cañete, Bai Nhor Dodog, Fritz Evar Quije		Use Case Diagrams
Activity Diagrams	Alenne Jasper Cañete, Bai Nhor Dodog, Fritz Evar Quije		Activity Diagrams
Prototype Design	Bai Nhor Dodog, Fritz Evar Quije		Prototype Design

3.2.2 Visualizing Workflow

In order to avoid work overload, the proponents decided to create a visualization of the workflow. The development phase of visualizing workflow will include a Kanban board that covers the stages of to–do, in–progress, and complete for the team to view the activities in progress, have already been completed, and to be started next.

3.2.3 Limiting Work in Progress

In order to avoid activities from stacking up and ensure the team focuses only on completing an activity at hand first before taking up a brand-new one, the proponents decided to set up work in progress (WIP) limit in project development. The planned WIP limit to start with throughout the project development at the moment is 3.

3.2.4 Focusing on Flow

In order to keep a lookout for any workflow interruptions, the proponents decided to have a workflow metric to track and analyze lead time and cycle time per week to reduce the time spent on completing an activity and finish the project on time. Once this metric is laid out, the proponents will start in technical implementation.

3.2.5 Using Feedback Loops

In order to constantly improve and maintain the quality of the project until the end of the development, the proponents will seek efficient feedback through short team meetings with the capstone adviser and the project stakeholder. The planned short team meetings must occur twice a month to stay updated on the project progress and pitfalls.

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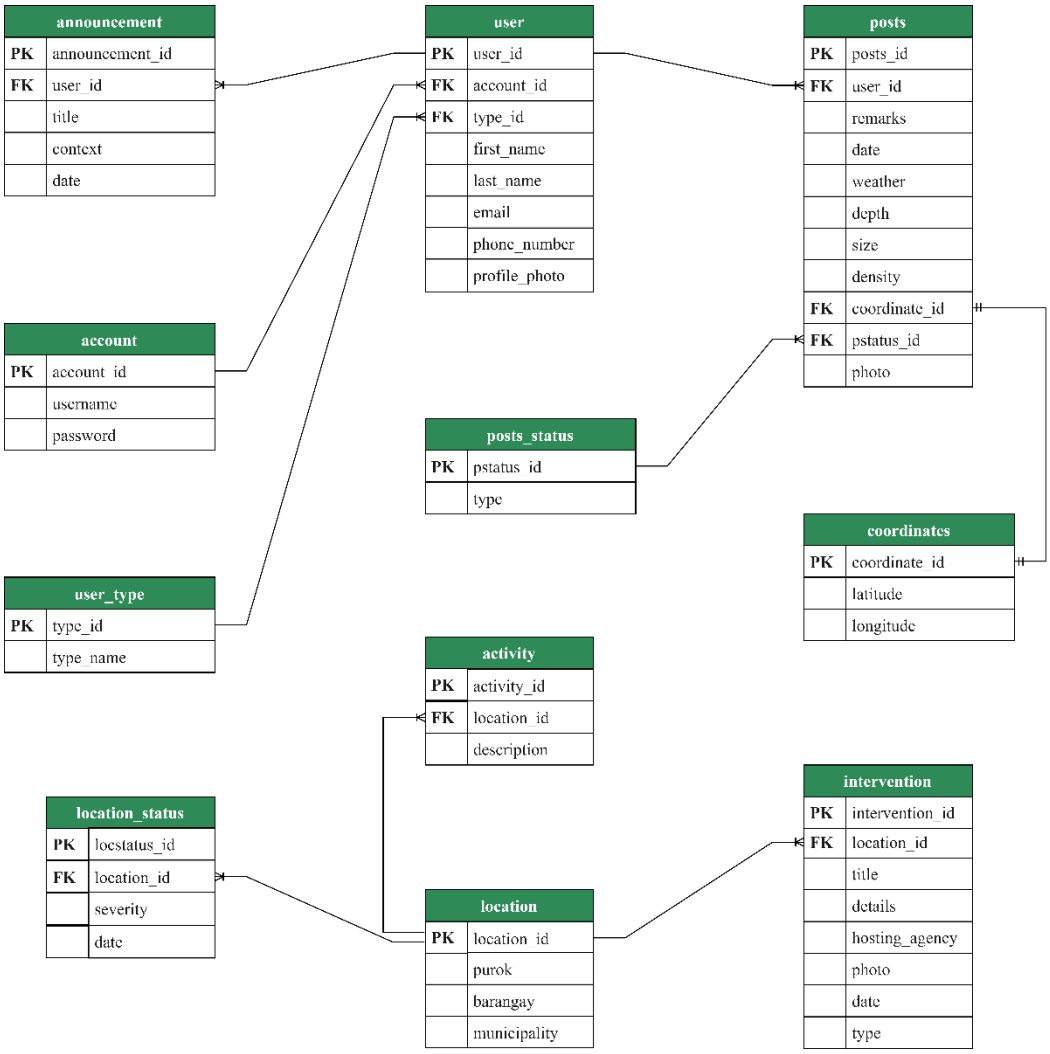
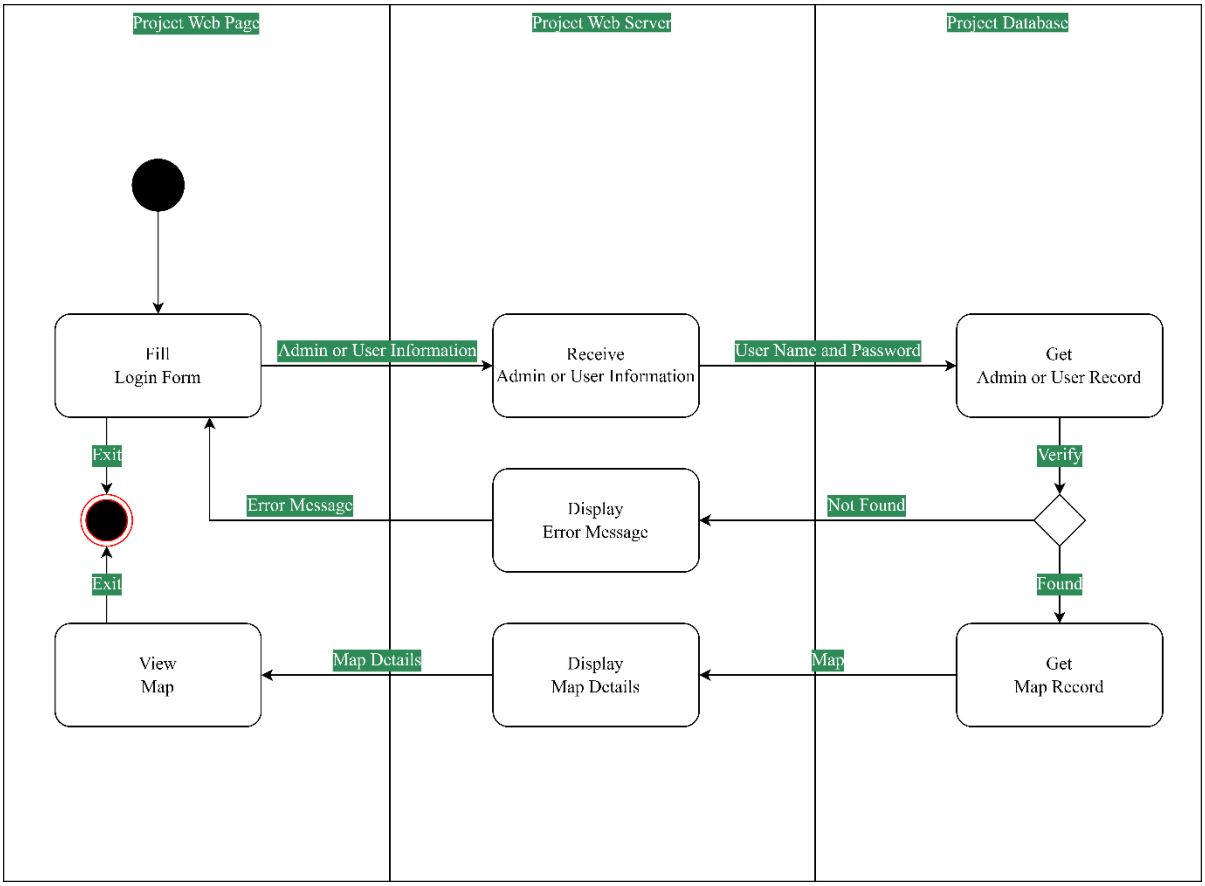
APPENDIX A

Diagrams

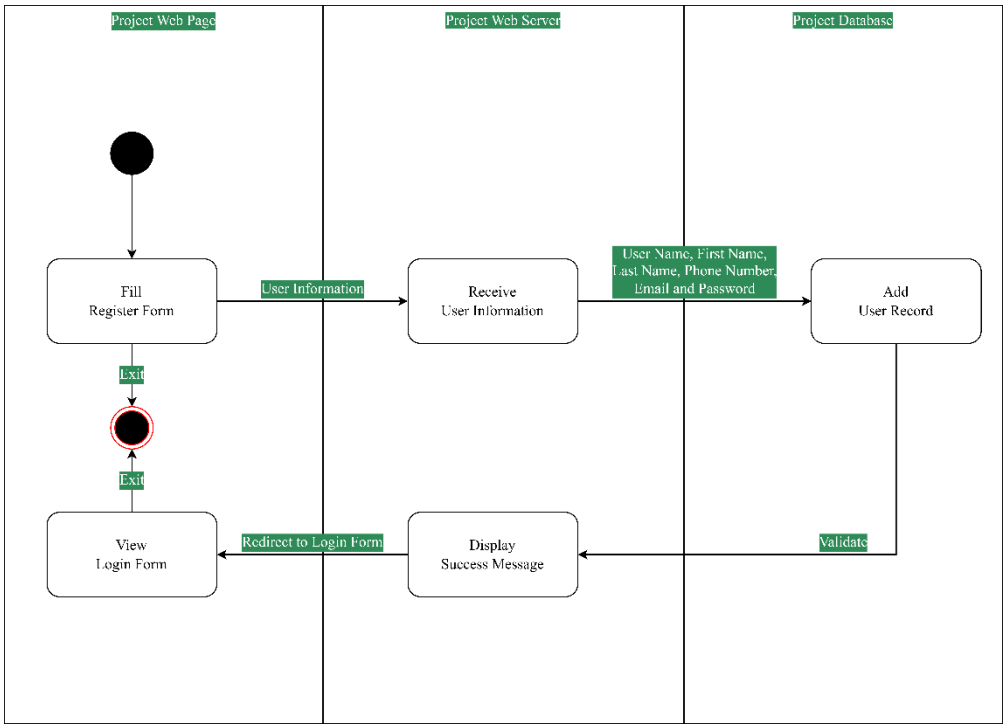
Appendix A.1. Project's Entity–Relationship



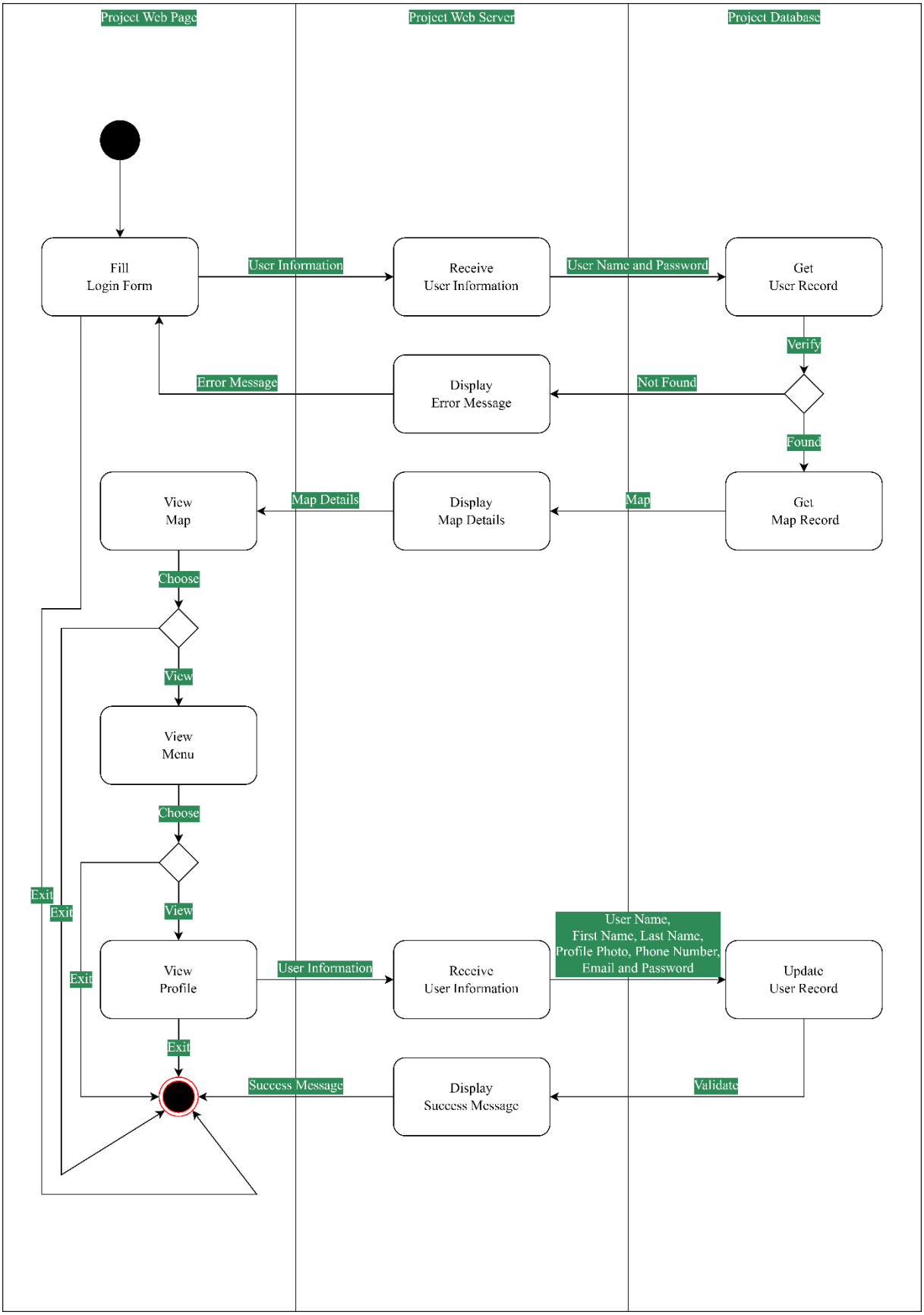
Appendix A.2. Contributor, Officer, and Admin's Login and View Map Activity



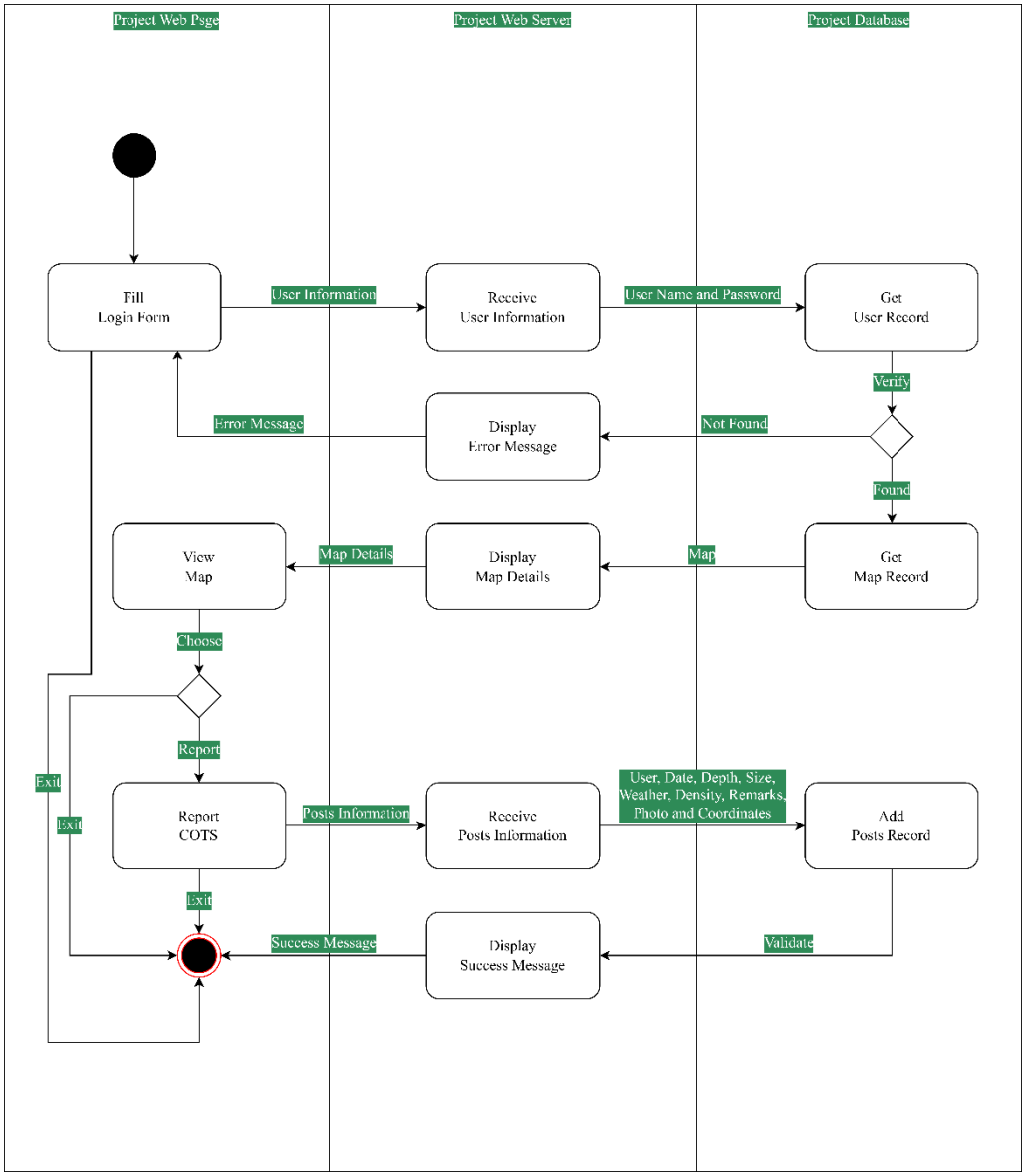
Appendix A.3. Contributor and Officer's Register Activity



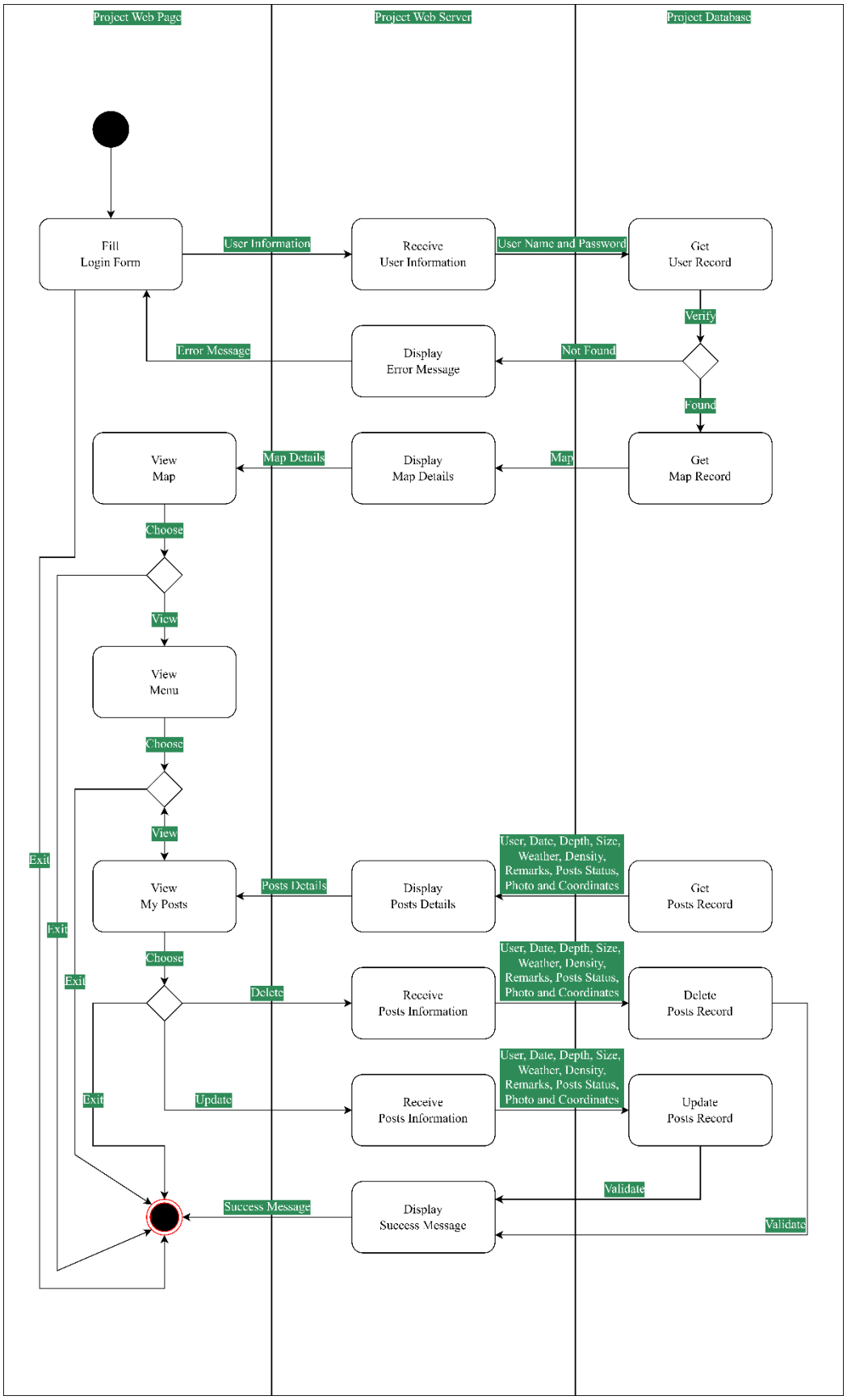
Appendix A.4. Contributor and Officer's Manage Profile Activity



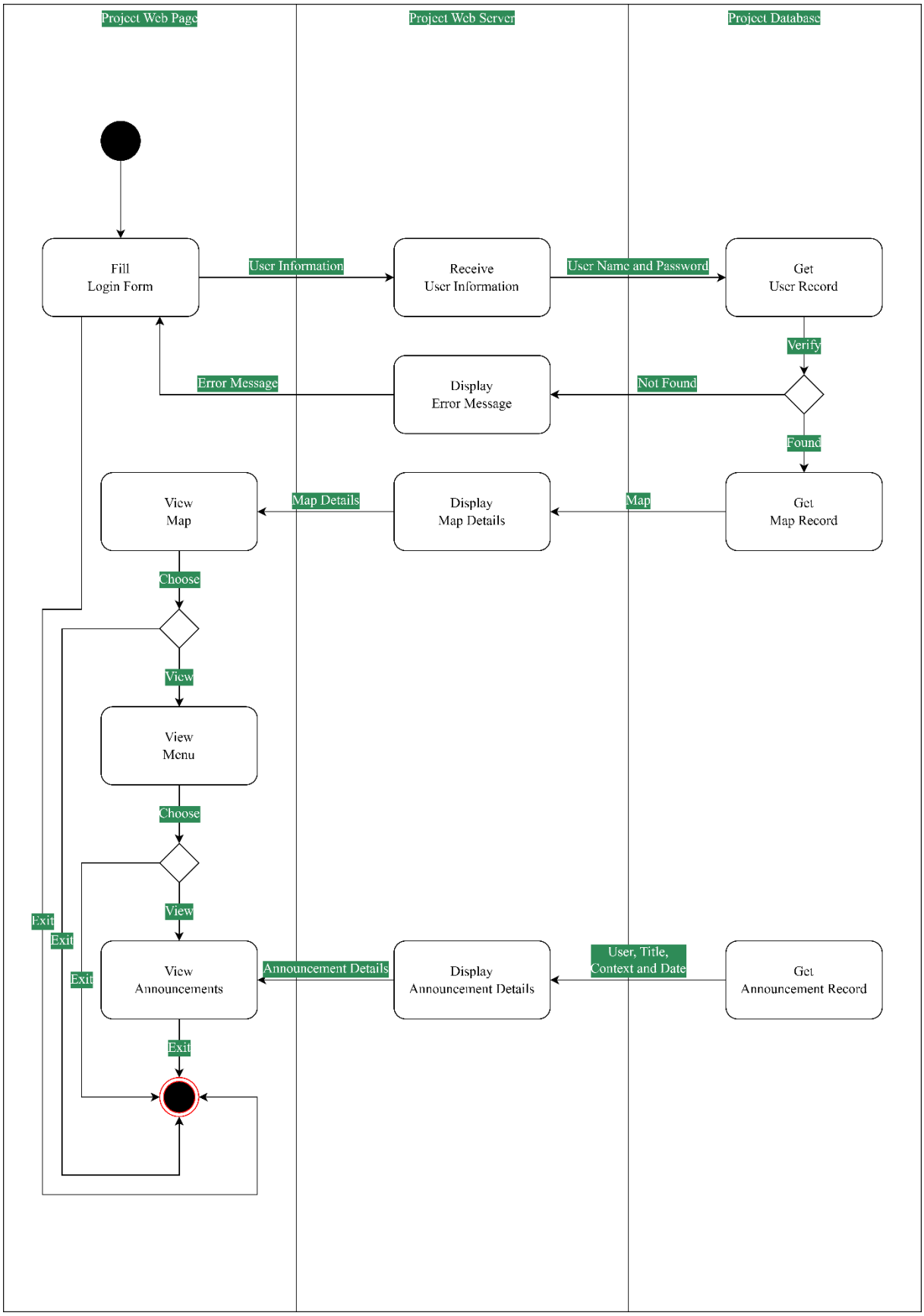
Appendix A.5. Contributor's Report COTS Activity



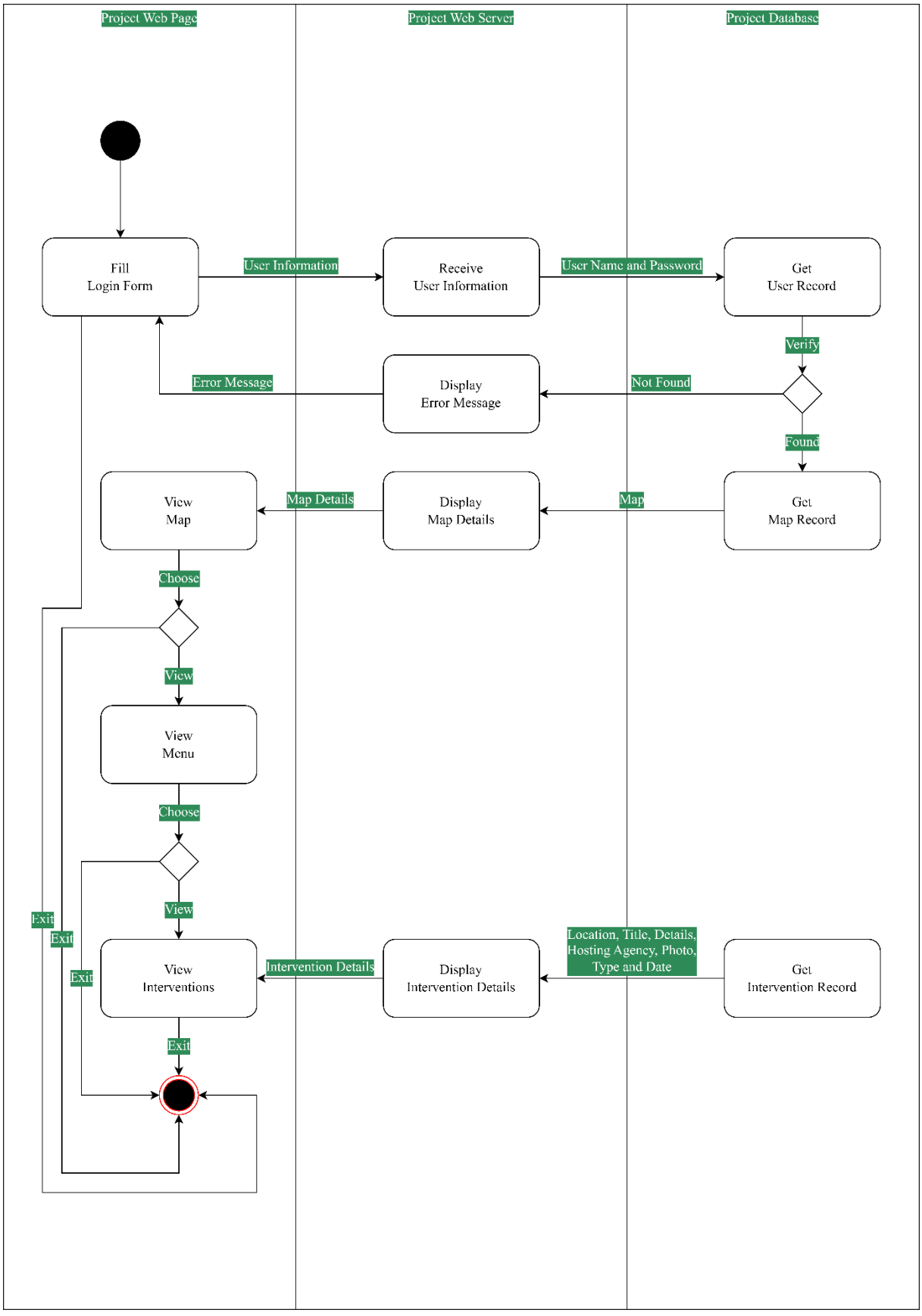
Appendix A.6. Contributor's Manage Posts Activity



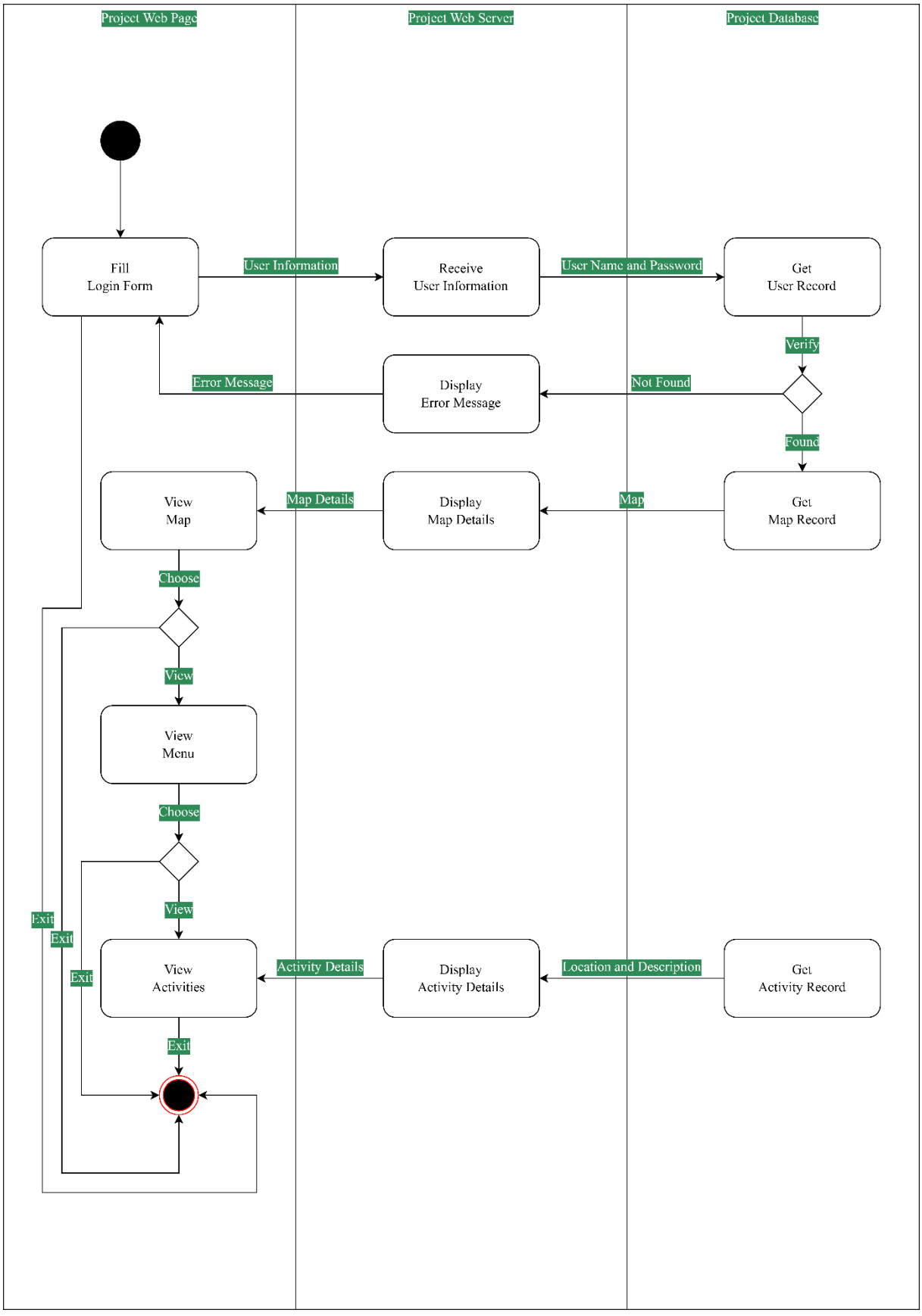
Appendix A.7. Contributor's View Announcements Activity



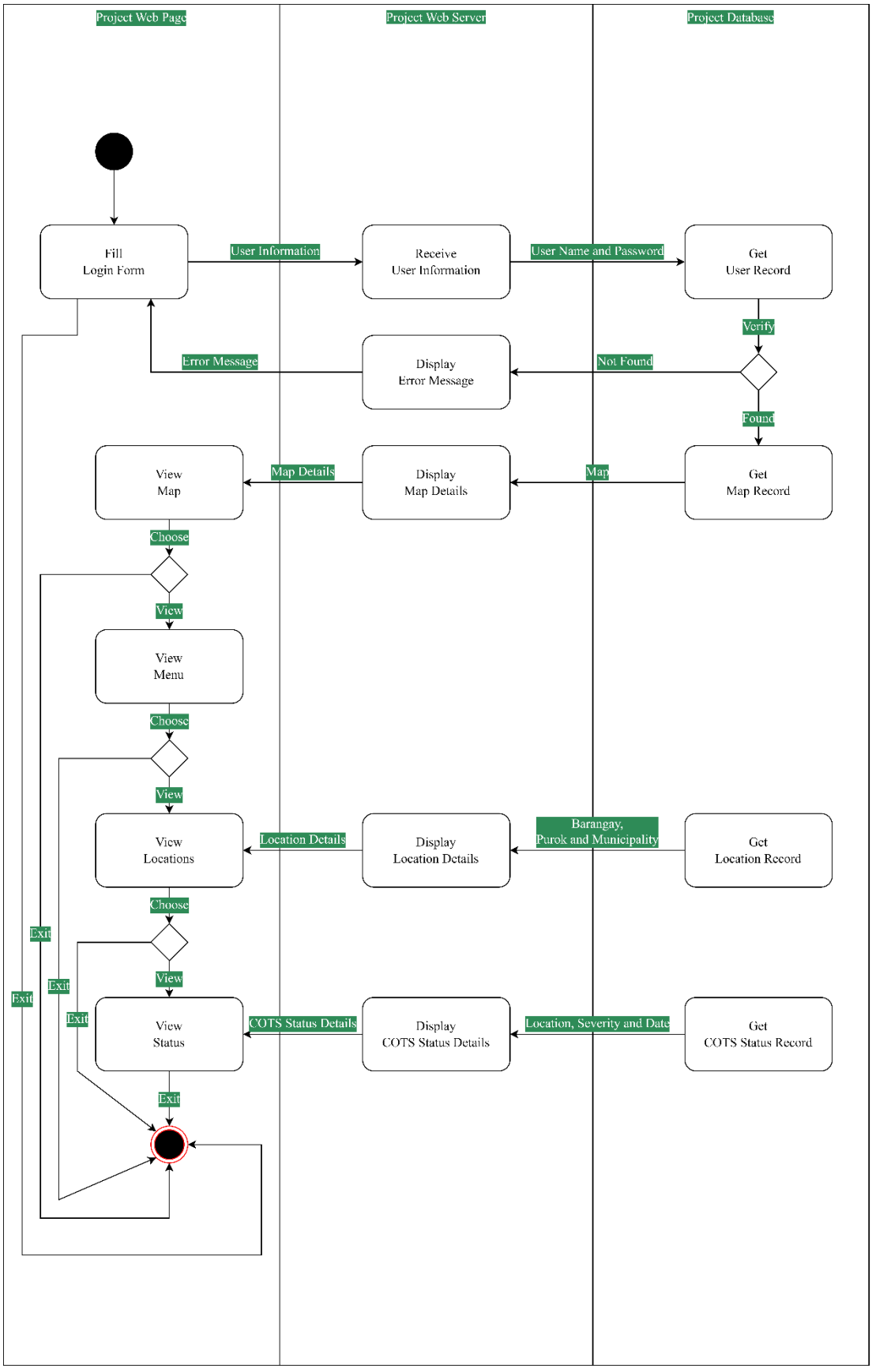
Appendix A.8. Contributor's View Interventions Activity



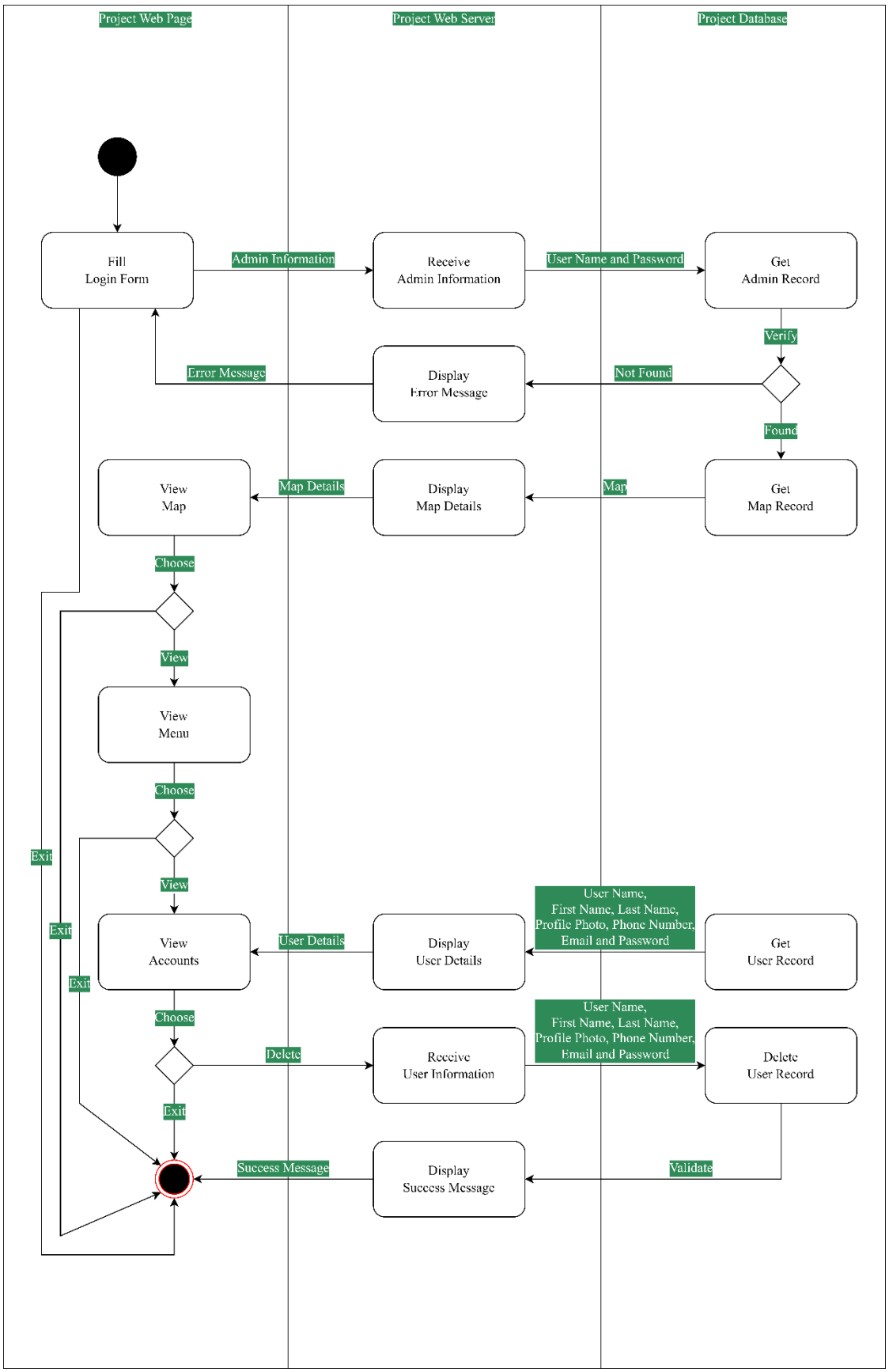
Appendix A.9. Contributor's View Activities Activity



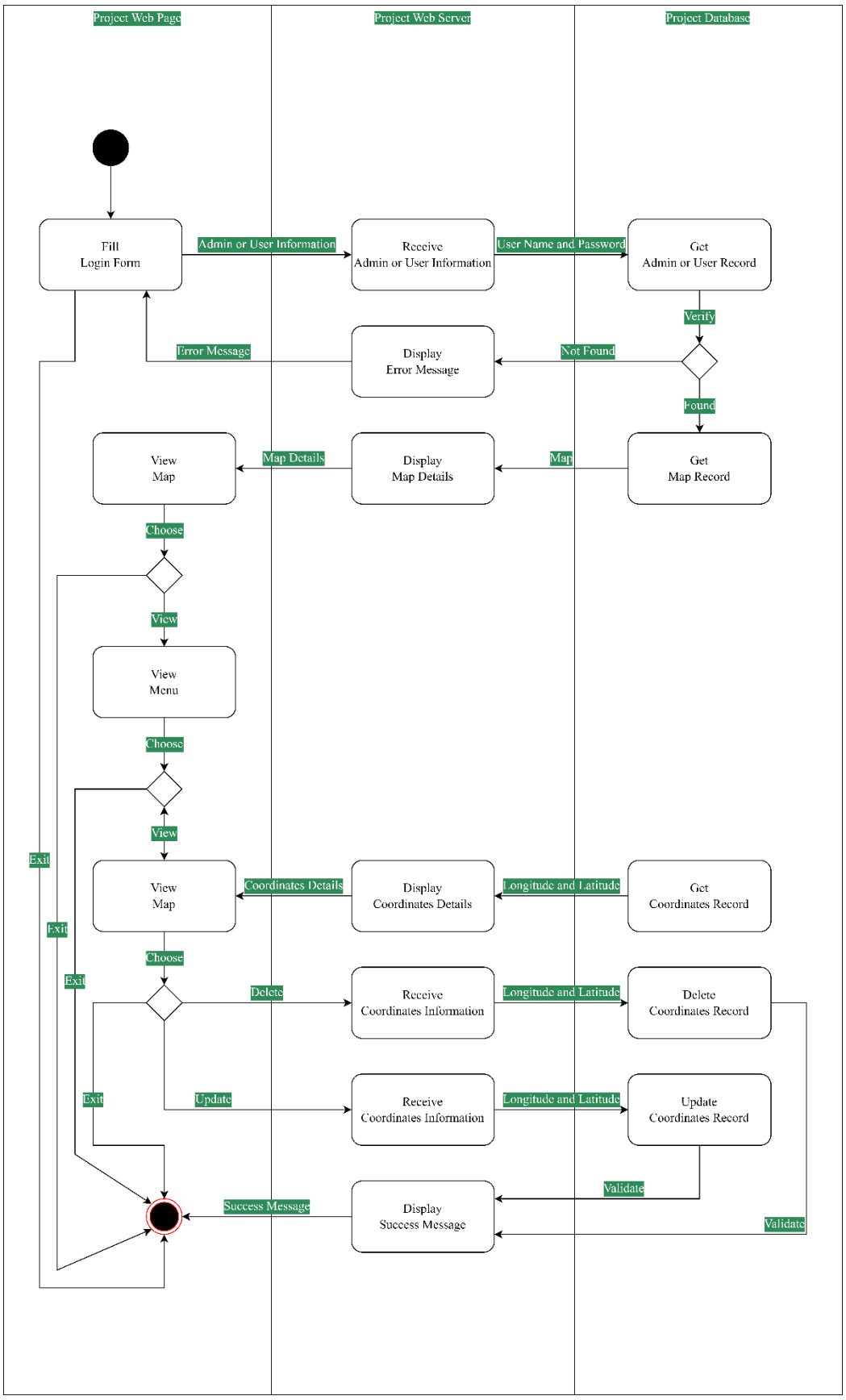
Appendix A.10. Contributor's View Status Activity



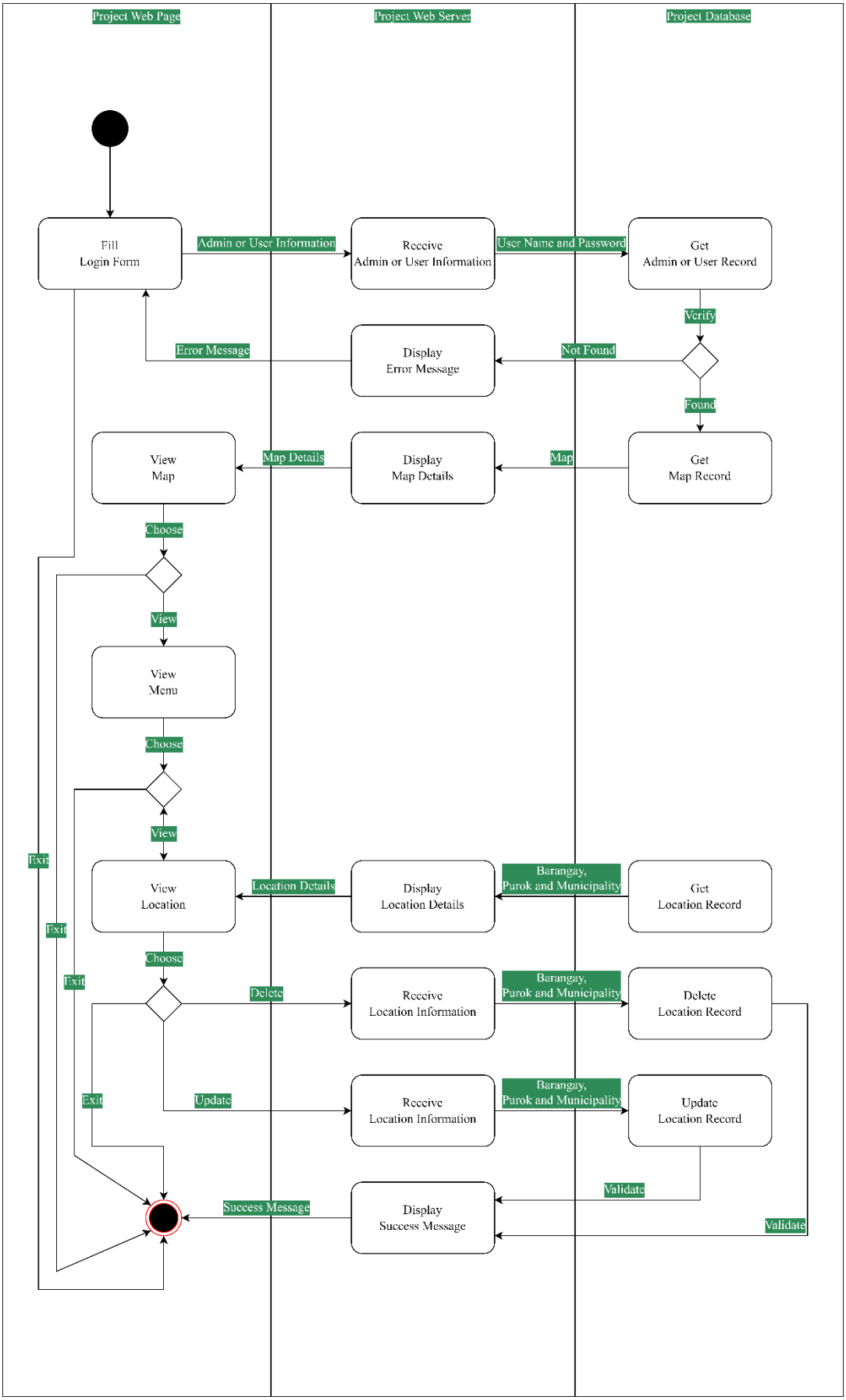
Appendix A.11. Admin's Manage Accounts Activity



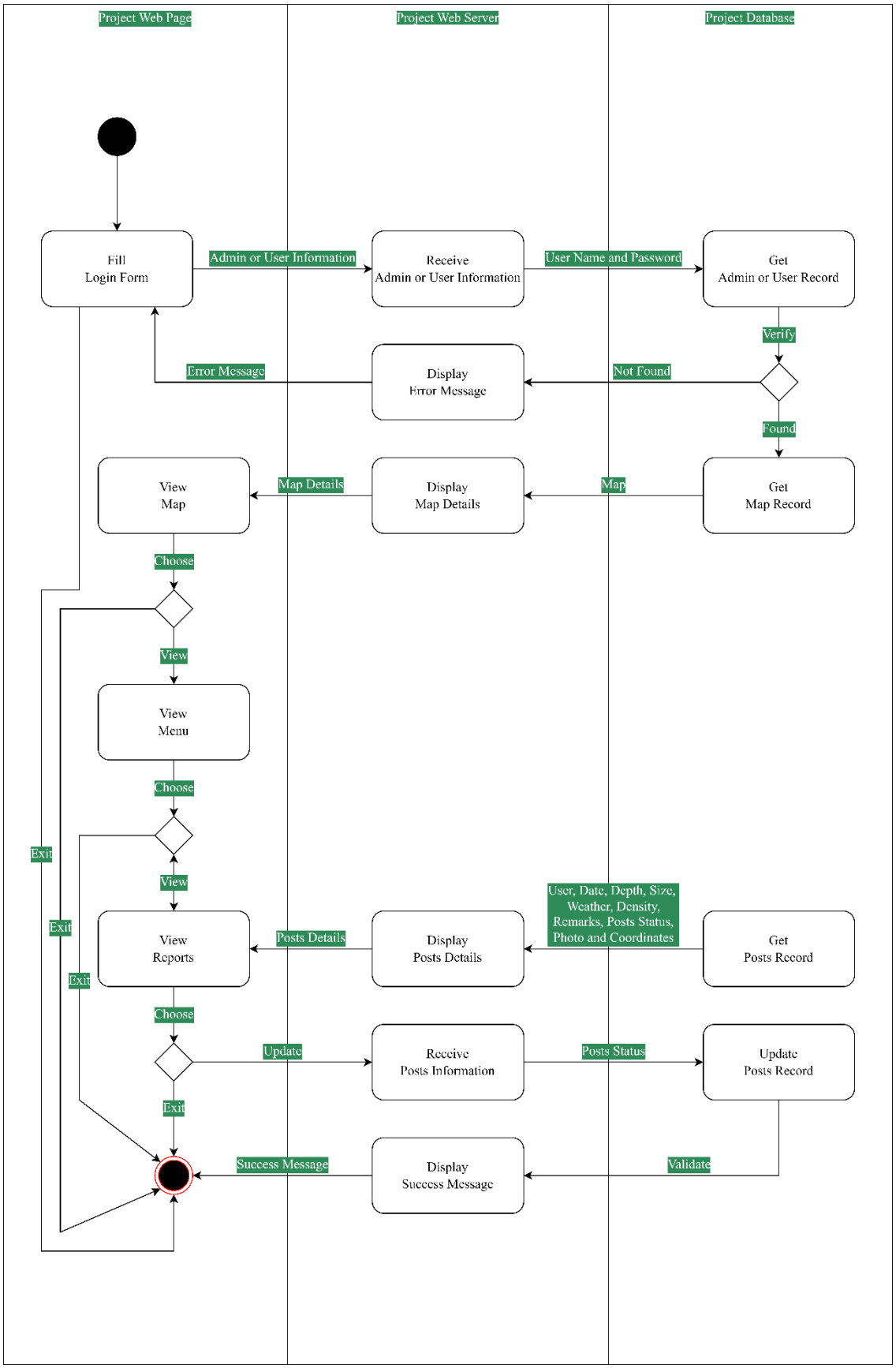
Appendix A.12. Admin and Officer's Manage Map Activity



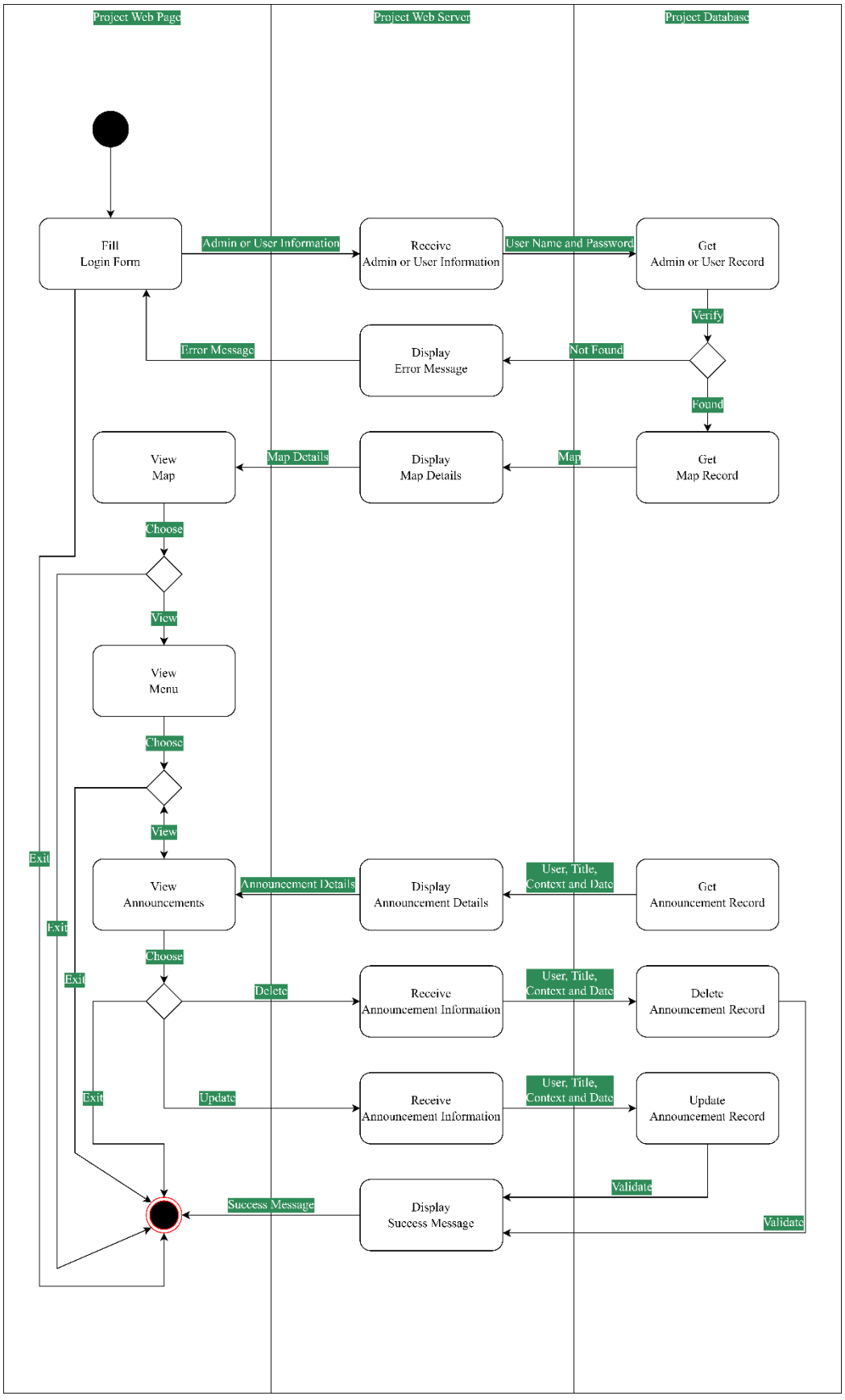
Appendix A.13. Admin and Officer's Manage Location Activity



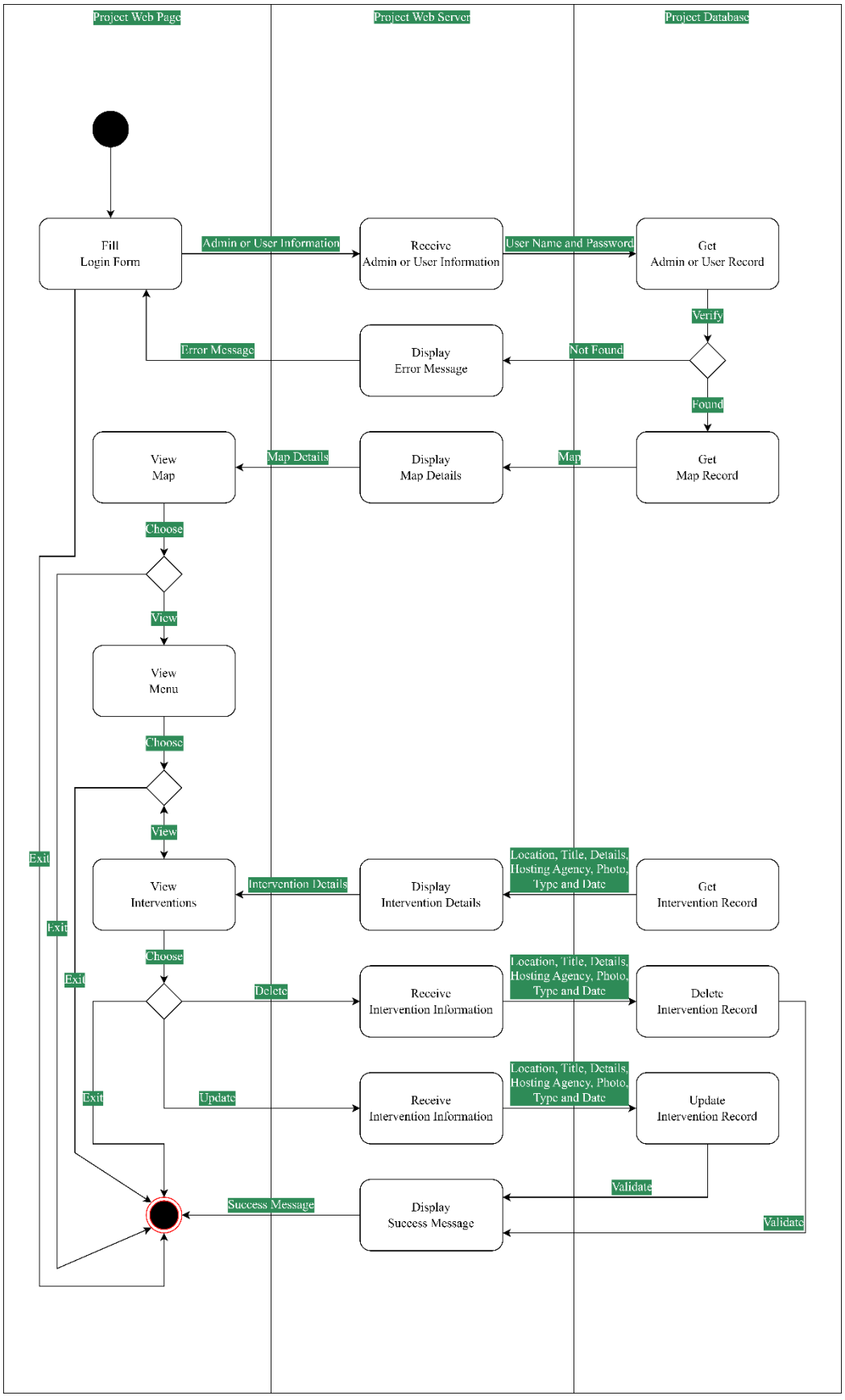
Appendix A.14. Admin and Officer's Manage Reports Activity



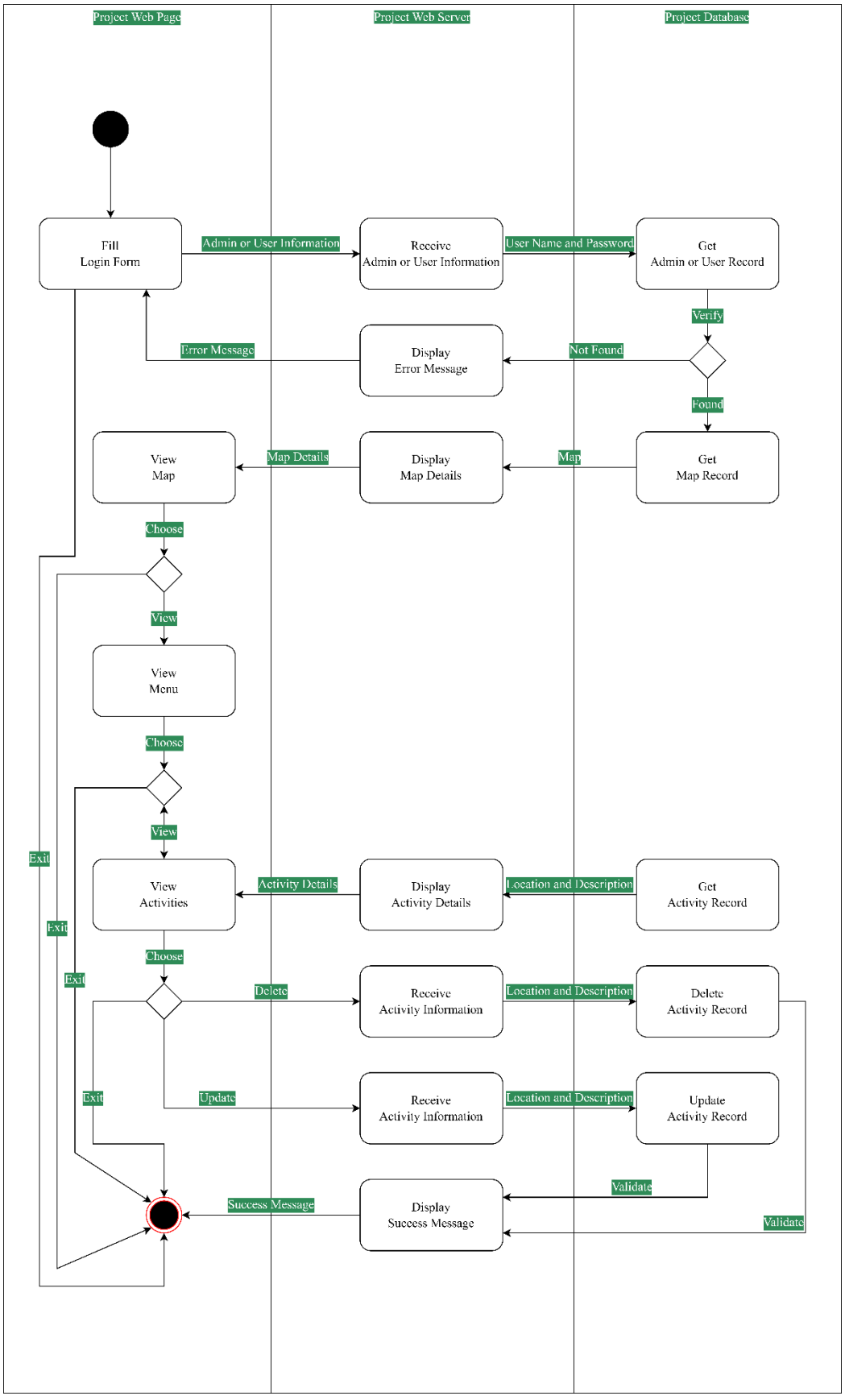
Appendix A.15. Admin and Officer's Manage Announcements Activity



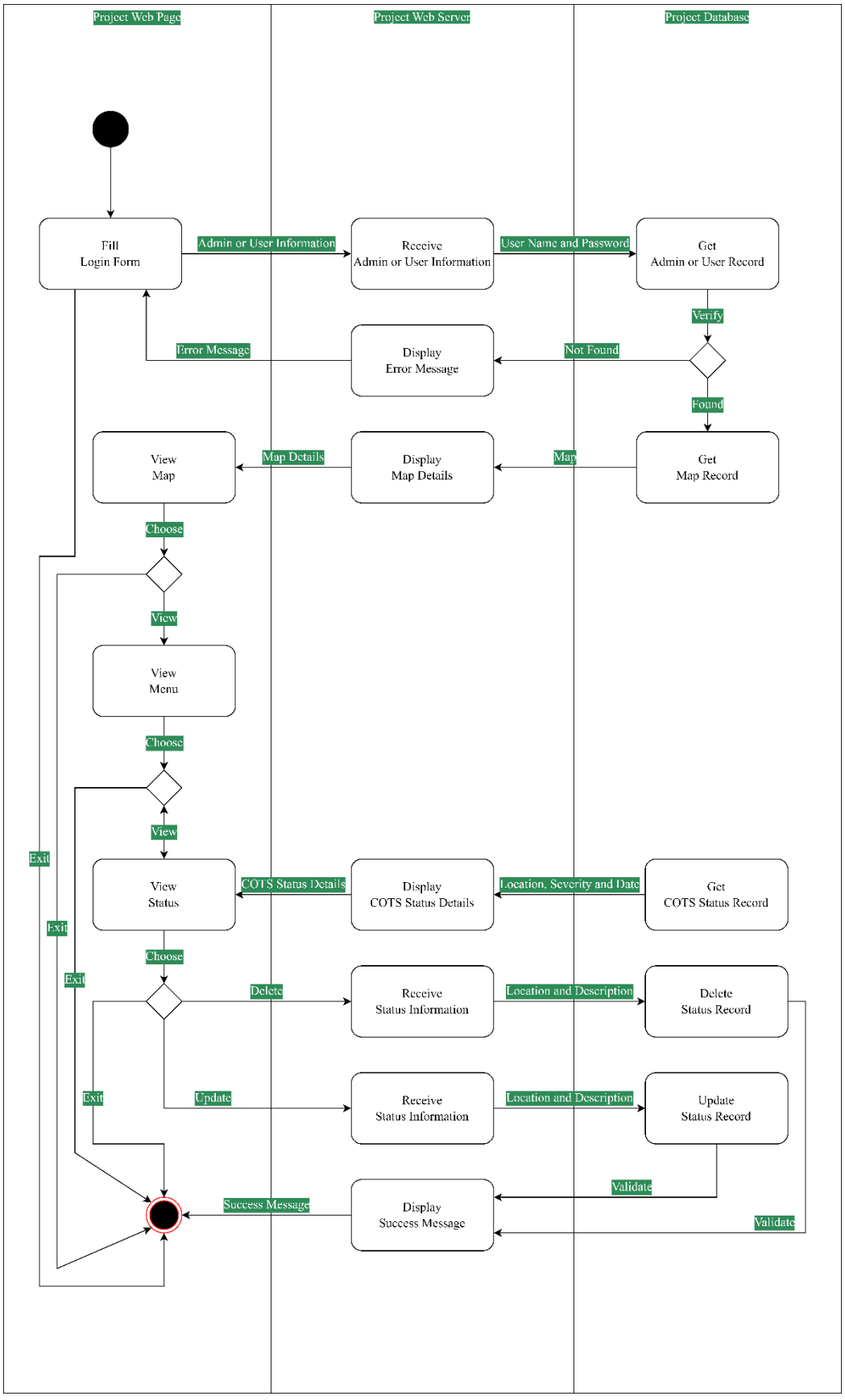
Appendix A.16. Admin and Officer's Manage Interventions Activity



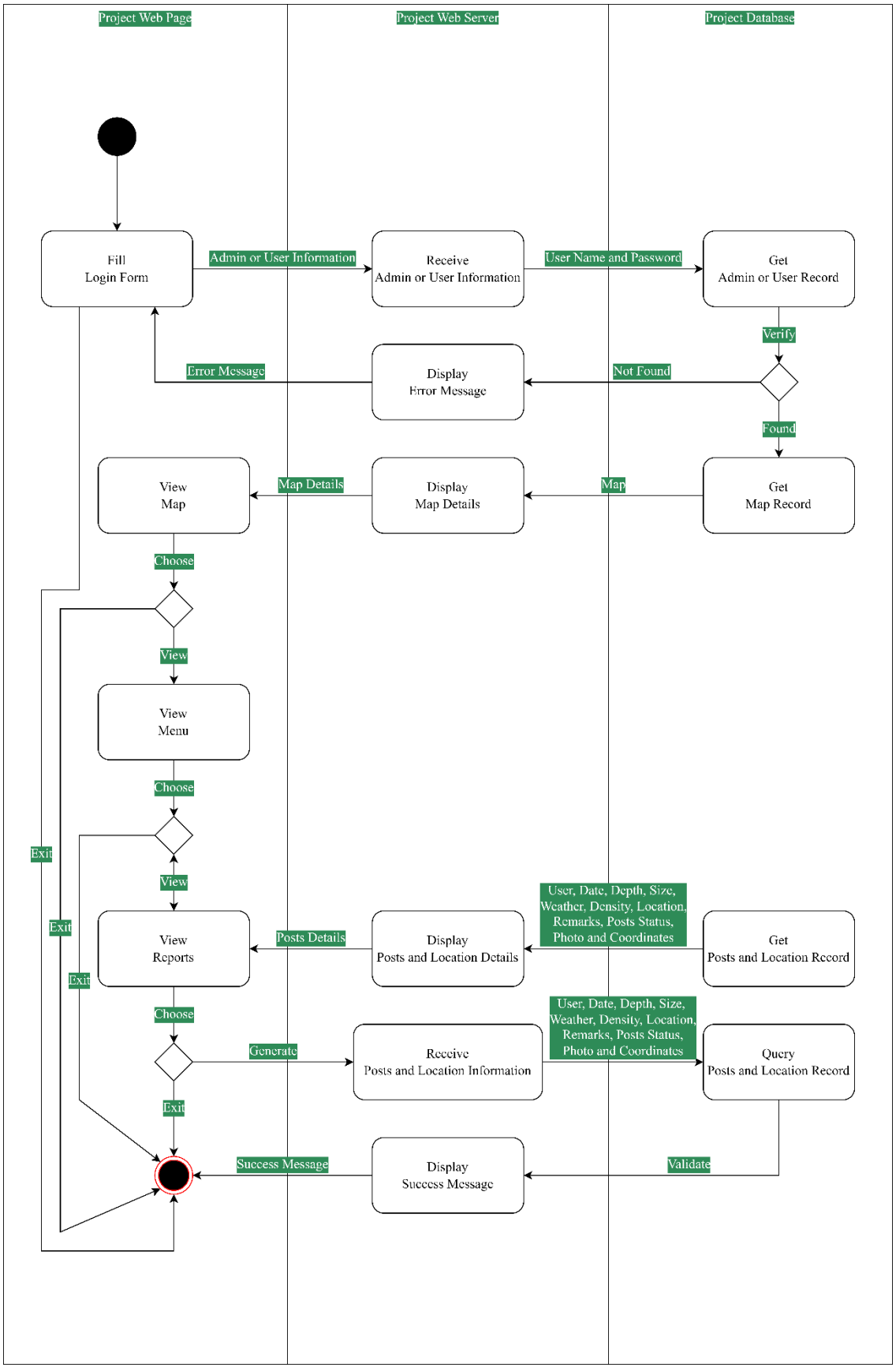
Appendix A.17. Admin and Officer's Manage Activities Activity



Appendix A.18. Admin and Officer's Manage Status Activity



Appendix A.19. Admin and Officer's Generate Reports Activity



Appendix A.20. Contributor, Officer, and Admin's Logout Activity